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Summary

A small but rich collection of pycnogonids was gathered by personnel of the R/V 'Aurora Australis' of the South Australian Museum, in Prydz Bay (stations from 68°50'E to 78°11'E), eastern Antarctica. The collection is listed by station number with 300+ specimens consisting of 25 species (2 additional species remain identified only to genus) in 12 genera and 6 families. There is one new species, Colossendeis adelpha, which is described, illustrated, and compared with its congeners. An aberrant hirsute specimen of Decolopoda australis Eights is illustrated and compared with typical specimens of that species.

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These collections were made on the R/V 'Aurora Australis' during February and March, 1991, while in Prydz Bay, eastern Antarctica (68°50'E to 78°11'E). This pycnogonid collection is diverse and includes specimens of 6 of the 9 described families with twelve genera and twenty five species (2 remain unnamed for lack of adult or undamaged material). It contains about 300+ specimens. A single new species, *Colossendeis adelpha*, is described, illustrated, and compared with a very similar congener. An aberrant hirsute specimen of *Decolopoda australis* Eights, the first example of this in the genus, is described, illustrated, and compared with more typical specimens of that common species.

MATERIALS

This material is deposited in the South Australian Museum (SAM), Adelaide, and has been given SAM registration numbers. Several surplus specimens have been retained at the National Museum of Natural History (NMNH), Smithsonian Institution, and exchanged for Antarctic specimens not represented in the SAM collections.

The literature cited under each species is abbreviated because the recently published Antarctic survey reports by Child (1994a, b, 1995a, b, c) contain most pertinent literature and bibliography. Its duplication under the pertinent species in this report was not thought necessary.

SYSTEMATICS

Class PYCNOGONIDA

Family AMMOTHEIDAE

This family contains the most heterogeneous group of genera found amongst the pycnogonids. All species have palps of from 4 to 10 segments, most have cheliphores and chelae in various stages of reduction or atrophy to complete loss, and all have ovigers carried by both sexes, although those of females are of reduced size.

Genus ***Achelia*** Hodge, 1864

Ammothea Leach, 1814 [part]
Ammothea (*Achelia*) Giltay, 1934.
Aduncorostris Fry & Hedgpeth, 1969

Diagnosis

Trunk discoid in dorsal outline, partially to fully unsegmented. Proboscis usually pyriform. Ocular tubercle usually low, with eyes. Abdomen short, erect. Cheliphores with short scape, chelae atrophied, reduced to knobs. Palps 7- to 9-segmented. Legs spinose, femur often inflated, cement gland with single tiny dorsodistal tube. Tarsus short, propodus very curved, with larger heel spines, smaller sole spines, robust main claw, and usually long auxiliary claws.

Achelia spicata (Hodgson, 1915)

Austrothea spicata Hodgson, 1915: 147.

Achelia spicata.– Calman, 1915: 57–60, figs. 13–14.– Child, 1994a: 10–11 [recent literature].

Achelia (*Ignavogriphus*) *spicata*.– Fry & Hedgpeth, 1969:109–110 [early literature], figs. 152–154, 157, 168–170, tables 13–14.

Material Examined

Sta. 25B (SAM E2930, 1♂).

Distribution

A common circumpolar species found from the intertidal to 1138 m.

Remarks

Species of this genus are known to be variable and this species is one with extreme variation. It even has two different morph groups in which the lateral processes are either crowded together or well separated. There are only two unvarying major characters in this species and both concern tubercles. The dorsolateral corners of the cephalic segment are smooth and do not have any form of tubercle, while tubercles are present more often than absent on these corners. The legs are also without tubercles except for the first coxae. These have only two dorsolateral setose tubercles instead of a more usual four found in many other species.

Genus ***Ammothea*** Leach, 1814

Lecythorhynchus Böhm, 1879

Leionymphon Möbius, 1902

Magnammothea Fry & Hedgpeth, 1969

Thavmastopycnon Fry & Hedgpeth, 1969

Athernopycnon Fry & Hedgpeth, 1969

Ecleipsothremma Fry & Hedgpeth, 1969

Anammothea Fry & Hedgpeth, 1969

Diagnosis

Habitus much larger than *Achelia*, trunk more slender, lateral processes well separated. Posterior rims of trunk segmentations expanded, often with tall conical dorsomedian tubercles. Ocular tubercle usually small, eyes well pigmented. Abdomen usually long. Cheliphores from fully chelate with reduced chelae, or atrophied chelae reduced to knobs, or scapes only without chelae, to no cheliphores whatsoever. Palps from 6- to 9-segmented, well developed. Ovigers 10-segmented in both sexes. Legs usually moderately long, cement gland small, with single dorsodistal pore.

Some species have small differences between the 4 anterior and 4 posterior propodi. These are: differences in heel spine number, overall length of the propodus, and length of the main and auxiliary claws.

Ammothea adunca Child, 1994a

Ammothea adunca Child, 1994a: 13–15, fig. 2.

Material examined

Sta. 52 (SAM E2931, 1♂).

Distribution

This species is known from a few localities in the vicinity of Heard Island on the Kerguelen Plateau, southern Indian Ocean, in depths of 175–800 m. The origin of this specimen, Prydz Bay, is due south of the type locality in the high Antarctic and extends its known distribution to that area.

Remarks

This recently described species is one of the few in this genus of mostly Antarctic species which has fully chelate cheliphores rather than having the chelae atrophy to become knobs in adults. Along with fully functional chelae, it also has very small palps which are shorter than the proboscis, while most species have palps longer than the proboscis.

There are four species of Antarctic and Subantarctic *Ammothea* which retain their chelae fingers in some form, whether functional or not, as adults. These are *A. longispina* Gordon, 1932, *A. gigantea* Gordon, 1932, *A. striata* (Möbius, 1902), and the present species. Of these four chelate species, only *A. longispina* and *A. adunca* have palps of reduced size and shorter than their narrowed proboscis. The palps sometimes have a reduced segment number (7, 8, or the usual 9 in *longispina*) from most other species which have nine. The present species also has palps with a reduced segment number (6 or 7), suggesting that the palps, at least in these two species, are in a transitional phase progressing toward reduced segment numbers. No specimens with the usual 9 segments of others have been found in this species.

The proboscis of both species is peculiar among ammotheids. In *A. longispina*, it is long, very

slender, and tapering to a narrow distal tube. The taper is even longer and narrower in juveniles. In *A. adunca*, it is swollen in its basal third and downcurved with its distal two thirds having a smaller diameter and a banana shape. The genus *Ammothea* is unique among the genera of pycnogonids in having such a diversity or reduction of cheliphore and palp segments. Its species range from having no cheliphores in any form to those with fully chelate cheliphores in conjunction with palps of 6 to 9 segments. The latter character of reduced palp segment number is not unique to *Ammothea*, but is shared by many species of the ammotheid genus *Tanystylum*.

Ammothea allopodes Fry & Hedgpeth, 1969

Ammothea spinosa var. Gordon, 1944: 50–51, figs. 16a–16e, 17.

Ammothea (*Mathoma*) *allopodes* Fry & Hedgpeth, 1969: 85–87, figs. 104, 105, 126–129.

Ammothea allopodes.– Clark, 1977: 174–175 [key].–Child, 1994a: 12–13 [key], 15.

Material examined

Sta. 52 (SAM E2932, 1♂, 2♀).

Distribution

This species has been taken at only a few localities which appear to encircle the Antarctic continent. It is known from depths of 210–540 m. It cannot be considered common.

Remarks

The bulbous chelae with atrophied fingers dorsal to the short egg-shaped proboscis help identify this relatively small species. Its dorsomedian trunk tubercles are almost square distally in lateral view and its moderately tall ocular tubercle is about equal to the height of these tubercles. This is one of the few *Ammothea* species which have shorter, more robust anterior propodi with an additional heel spine. The posterior four propodi are more slender, longer, and have only two heel spines in *A. allopodes*.

Ammothea glacialis (Hodgson, 1907)

Leionymphon glaciale Hodgson, 1907: 50–52, pl. VII, fig. 3.

Ammothea (*Ammothea*) *glacialis*.– Fry & Hedgpeth, 1969: 75–77 [literature], figs. 104, 105, 109–111.

Ammothea glacialis.– Clark, 1977: 174–175 [key].– Child, 1994a: 12–13 [key], 23–24.

Material examined

Sta. 52 (SAM E2933, 1♂); sta. 53 (SAM E2934, 1♂ with eggs, 1♀); sta. 54 (SAM E2935, 1♀).

Distribution

Distribution of this species is disjunct and is probably an artefact of uneven collecting efforts. It has been captured in the vicinity of South Georgia Island and along the eastern quadrants of the Antarctic continent in 0–500 m. It would be expected to occur in the vicinity of the Antarctic Peninsula and Palmer Archipelago, but the intensive American collecting efforts in these areas have not brought to light any additional specimens. Fry and Hedgpeth (1969:76, fig. 111) record this species as collected on the Antarctic Peninsula at one station (66°S, 67°W), but I have not found this specimen in the National Museum collections. There are not enough records for this species to provide significant distributional information.

Remarks

This rather large species has a massive, long, and inflated proboscis with very short cheliphores. Its dorsomedian tubercles are slightly taller than the low ocular tubercle but the dorsodistal tubercles on the lateral processes are very low or are lacking. All eight propodi are similar and do not vary in anterior and posterior pairs.

Ammothea spinosa (Hodgson, 1907)

Leionymphon spinosum Hodgson, 1907: 49–50, pl. VII, fig, 2.

Ammothea spinosa.– Child, 1994a: 12–13 [key], 27–28 [literature].

Material examined

Sta. 44 (SAM E2936, 3♂, 3♀, 3 Juv.); sta. 45 (SAM E2937, 1♂), sta. 53 (SAM E2938, 1♂ with eggs, 1♀).

Distribution

Records for this uncommon species extend from the Magellanic regions to the Antarctic Peninsula and Ross Sea in 73–1119 m. Its distribution is

distribution is scattered and inconsistent which possibly represents a collecting artefact rather than a true range of distribution.

Remarks

This small species has rather long anterior-pointing dorsomedian trunk tubercles and its ocular tubercle is slightly taller than these tubercles. It has conspicuous paired dorsodistal lateral process tubercles. The proboscis is a short cylinder and its slender cheliphores are almost as long as its proboscis. This is another species with variation between anterior and posterior propodi. The propodi of the first and second leg pairs are short, robust, and have more sole and heel spines than the slender and longer third and fourth propodi pairs.

Genus ***Austroraptus*** Hodgson, 1907

Habitus small, trunk compact, ovoid in dorsal aspect, without segmentation lines. Dorsum without median tubercles (except for 1 species), ocular tubercle usually low, eyes well developed. Proboscis small, shorter than trunk, distally tapered with tiny terminal diameter. Cheliphore scapes short, chelae reduced but some retain fingers in adults. Palps 5- to 8-segmented. Ovigers 10-segmented in both sexes. Tarsus very short. Propodus with 3–4 heel spines, long main claw, and short auxiliary claws often lost.

Austroraptus polaris Hodgson, 1907

Austroraptus polaris Hodgson, 1907: 54–56, pl. VII, fig. 2.– Fry & Hedgpeth, 1969: 116–117 [literature], figs. 174–186.– Child, 1994a: 31 [key], 33.

Material examined

Sta. 47 (SAM E2939, 1 ♀).

Distribution

This is another of many Antarctic genera and species with disjunct or scattered distributional records, most undoubtedly reflecting collecting situations rather than true geographic range. It is known from South Georgia, the South Shetlands, Antarctic Peninsula, Ross Sea, and a few localities in the eastern Antarctic quadrant in 50–569 m.

Remarks

Species of this genus all have very short proboscides which are usually bottle-shaped with a 'neck' which tapers to a small point. They otherwise have many of the characters of the variable genus *Achelia*. The palps often have fewer segments: 5-, 6-, or 8-segmented (this species has 6). Their trunks can have dorsomedian tubercles, but most, including this species, have none, and the chelae fingers in this species are atrophied into tiny bumps.

Family AUSTRODECIDAE Stock

This family of only two genera contains extremely small species which are predominantly Antarctic and Southern Hemisphere residents. The species in the genus represented herein all have tubular pipette-like proboscides which have rings or annulations over most of their surface. Their ocular tubercles are slender anterior-pointing cones with distal eyes. They lack cheliphores entirely. The palps originate on lateral extensions of the cephalic segment, are very long and 5-segmented, although more than one species has the distal two segments coalesced. Their ovigers are reduced to very tiny nonfunctional appendages of 1, 2, 3, 4, or 6 segments. None have been described with 5 oviger segments. The ovigers form the basis, along with the presence or absence of auxiliary claws, for dividing species into Sections for easier identification.

Genus ***Austrodecus*** Hodgson, 1907

Species in this genus are among the smallest of all Pycnogonida with trunk lengths of 4–5 mm. They lack cheliphores entirely as adults, and have very reduced tiny ovigers of 1 to 4, or 6 segments with few setae or none. Only one species is included in this collection.

Austrodecus glaciale Hodgson, 1907

Austrodecus glaciale Hodgson, 1907: 53, pl. VIII, fig. 1.– Child, 1994b: 54–56 [key], 63–67 [literature], fig. 6.

Material examined

Sta. 61 (SAM E2940, 1 specimen).

Distribution

This is the most common species of a predominantly Antarctic genus (Child, 1994b: 63–

67, lists 2300+ specimens). It has been collected on the Campbell Plateau of New Zealand, in the vicinity of South Georgia and in most commonly collected areas of the Antarctic continent in sublittoral depths to 2100 m.

Remarks

Austrodecus specimens are easily separated from other genera and families but difficult to separate among themselves. This is a rather generalized species among many with more or less conspicuous tubercles and other architectural characters. It has broad conical dorsomedian trunk tubercles each with 1–2 short apical setae. The proboscis is slightly longer than its rather robust palps. This group of species can sometimes be separated by use of the first coxae dorsodistal tubercles. The anterior pair of coxae have a single tubercle and the other six coxae have two in this species where first coxae tubercles vary from one to two in various combinations (all first coxae with paired tubercles, or 1: 2: 2: 1 tubercle arrangement, or 1: 1: 2: 2, and some with 1: 2: 2: 2, as in this species).

Males have a broadly pointed triangular cement gland opening at the midventral femur while most others have no triangular opening or a narrower triangular or pointed orifice. Ovigers of this genus are on both sexes and are extremely tiny and difficult to discern but this species is one of the majority having six segments. It forms the basis of the *glaciale*-section in identification keys to the genus.

Family COLOSSENDEIDAE Hoek

Many species in this family are the largest of all pycnogonids and one has a leg span of a half metre or even more. They are predominantly denizens of the deep sea and walk on extremely long slender legs. The trunk of the largest specimens may only be 3–4 cm long. Their proboscis is usually longer to much longer than the trunk. The genus *Colossendeis* lacks cheliphores entirely in adults, while the genera *Decolopoda* and *Dodecolopoda* have them. The palps are mostly very long and slender, and the extremely long ovigers have a distal curved part called a strigilis which is used to clean the long appendages. The oviger also has a terminal claw. The leg segments are slender and protracted and the distal segments merely form a slender extension of the leg. The main claw is usually quite long and auxiliaries are always lacking.

Genus ***Colossendeis*** Jarzynski, 1870

Species in this usually deep-sea genus are giants of the Class Pycnogonida and specimens with leg spans of 300–400 mm are common. Adults are quite slender, usually are without trunk segmentation, lack any form of cheliphores, and usually have a very long proboscis which is carried horizontally (sometimes with a distal upward or downward curve). There is a great degree of intraspecific variation among species in this genus and, unfortunately, the more specimens collected, the greater the range of variation found in most species.

Colossendeis adelpha, new species

Fig. 1

Material examined

Sta. 41, 1 holotype specimen (SAM E2941).

Distribution

Known only from station 41 in Prydz Bay, in 333–341 m.

Description

Extremely large trunk size for this genus, leg span 352 mm. Trunk glabrous. Lateral processes slightly longer than their distal diameters, separated by their diameters, glabrous. Neck very short. Ocular tubercle a small rounded truncate cone with low round anterodistal tubercle, eyes very indistinct, without pigment. Proboscis robust, little longer than trunk, distal half inflated to 1.5 times proximal stem and moderately downcurved, mouth rounded. Abdomen a small narrow cylinder not extending to distal rim of fourth leg first coxae, downcurved.

Palp robust, third segment longest, about 1.25 length of fifth segment. Distal segments short cylinders, sixth little longer than fourth, seventh through tenth each shorter than last. Armed with fields of tiny short setae distally on fifth and on dorsal surface only of distal five segments.

Oviger typical, robust, strigilis spines plain, in multiple rows, very short, distally rounded, without larger distal spine creating subchela as in other species. Terminal claw slender, well curved, about 0.66 length of terminal segment.

Leg with dorsal and distally ventral row of very short spines. First coxae with group of small rounded tubercles on dorsodistal rim, second coxae very short, little longer than first and third. Femora and second tibiae of equal length, first

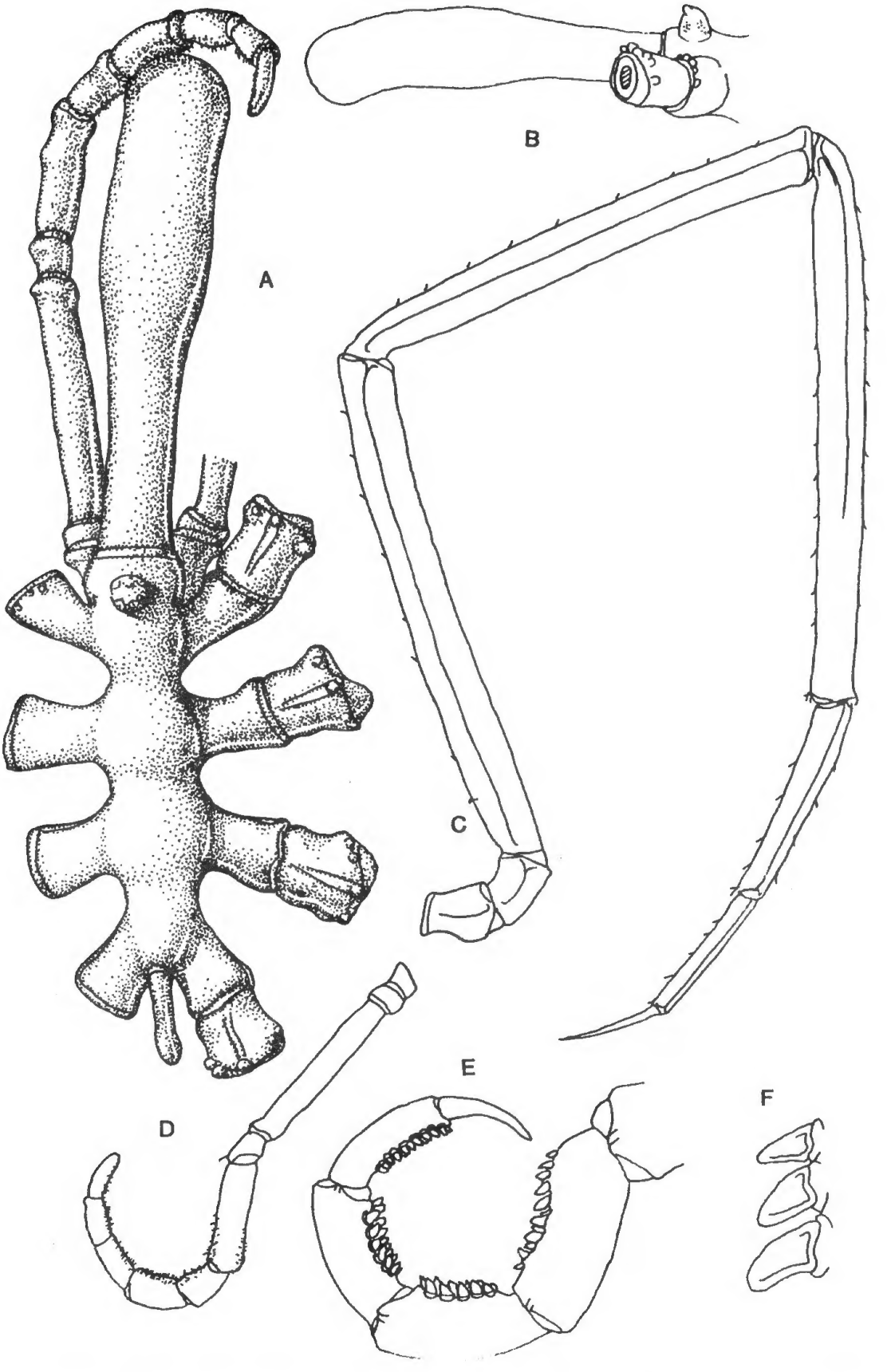

FIGURE. 1. *Colossendeis adelpha*, new species, holotype: **A**, trunk, dorsal view; **B**, trunk anterior, lateral view; **C**, third leg; **D**, palp; **E**, oviger strigilis, enlarged; **F**, three strigilis spines.

tibiae slightly shorter. Tarsus longer than propodus, with greater diameter, both segments with few tiny sole spines. Claw almost 0.66 length of propodus. Sexual pores indistinct.

Measurements of holotype in mm.

Trunk length (proboscis insertion to tip 4th lateral processes), 23; trunk width (across 2nd lateral processes), 13.4; proboscis length, 24.2; abdomen length, 4.8; third leg, 3 coxa combined, 18; femur, 39.5; tibia 1, 36.8; tibia 2, 39.5; tarsus, 16.2; propodus, 11.3; claw, 7.9.

Etymology

The species name (Greek: *adelphus*, meaning brotherly, closely related) refers to its close relationship to *C. australis* Hodgson, 1907.

Remarks

Although this species is in many characters closely related to *Colossendeis australis* Hodgson, there are several prominent differences. The proboscis of the new species is much more slender in its proximal half, is downcurved only in its distal half, and has a very rounded oral surface. That of *C. australis* is inflated to its greatest extent toward the proximal half, thus giving it a larger overall diameter. It is more or less downcurved throughout its length and has a very flat oral surface.

The palps of *C. adelpha* are quite robust and have relatively short segments in relation to each other and bear a set of tiny dorsal setules. There are no setae on the ventral surface where they are usually found. Only one other species as far as can be discerned, *C. scoresbii* Gordon, 1932, has dorsal rather than ventral setae or setules on the palps. The palps of *C. australis* are quite long, very slender in segment lengths versus diameters, and have ventral setae. The propodus and claw are both longer in relation to the tarsus in this new species than in the same segments of *C. australis*.

One of the most revealing differences is in the oviger strigilis spines. The plain spines of the new species are mostly the same size on each segment while those of *C. australis* increase in size proceeding distally on any single segment. The distal spine of the terminal segment is very large and forms a subchelate process with the adjacent claw. There is no similar chelate process on the ovigers of *C. adelpha*.

Colossendeis australis Hodgson, 1907

Colossendeis australis Hodgson, 1907: 59, pl. IX, fig. 1, pl. X, figs. 1–2.– Child, 1995b: 72–73 [key], 73–74 [literature].

Material examined

Sta. 49 (SAM E2942, 1 spec.), sta. 53 (SAM E2943, 1 spec.), sta. 57 (SAM E2944, 1 spec.), sta. 61 (SAM E2945, 11 spec.).

Distribution

This species has a scattered but almost circumpolar distribution in 143–3931 m. It has been collected in the Falkland Islands and Magellanic regions, South Georgia and South Sandwich Islands, and widely separate localities around the Antarctic continent. Its deeper collecting localities have usually been in Subantarctic basins while the shallower localities are high Antarctic.

Remarks

This species' ovigers have larger distal strigilis spines, unlike the previous species (see remarks under that species). They form a subchelate or pincer-like structure on the terminal segment, opposing the claw. Its proboscis is slightly longer than the trunk, widely inflated at midlength and, downcurved beyond this inflation. Its ocular tubercle is a broad low cone and the eyes are tiny. The distal three palp segments are subequal.

Colossendeis drakei Calman, 1915

Colossendeis drakei Calman, 1915: 11, 22–23, fig. 3.– Child, 1995b: 72–73 [key], 78 [literature].

Material examined

Sta. 41 (SAM E2946, 1 spec.), sta. 43 (SAM E2947, 1 spec.), sta. 45 (SAM E2948, 1 spec.), sta. 46 (SAM E2949, 1 spec.), sta. 52 (SAM E2950, 2 spec.), sta. 53 (SAM E2951, 6 spec.), sta. 58 (SAM E2952, 3 spec.).

Distribution

The distribution of *C. drakei* is extremely disjunct and spans an enormous depth range, suggesting that not all records involve the same species and that some have been misidentified. It has been, according to the records, collected south of Tasmania, off the Falkland Islands, South Georgia, South Sandwich, and South Shetland Islands, eastern Antarctica, and the Ross Sea. The shallowest record places it in 3 m while the deepest, 3000 m, is represented by the record from south of Tasmania.

Remarks

The most conspicuous character in this species is its unusually short proboscis which is only as long as the trunk or slightly shorter. The ocular tubercle forms a low pointed cone. Five distal segments of the palps are short, and the oviger terminal claw is also short and lacks the opposable large spine on the terminal segment. The propodus and tarsus are usually subequal and the claw is almost as long as the propodus.

Colossendeis megalonyx ssp. Fry & Hedgpeth, 1969

Colossendeis megalonyx Hoek, 1881: 67, pl. IX, figs. 1–3.

Colossendeis megalonyx ssp. Fry & Hedgpeth, 1969: 30–32, figs. 7, 8, 11–16, 23. Child, 1995b: 72–73 [key], 86–87 [literature].

Material examined

Sta. 40 (SAM E2953, 2 spec.), sta. 41 (SAM E2954, 1 spec.), sta. 44 (SAM E2955, 3 spec.), sta. 46 (SAM E2956, 4 spec.), sta. 48 (SAM E2957, 1 spec.), sta. 52 (SAM E2958, 6 spec.), sta. 53 (SAM E2959, 20+ spec.), sta. 54 (SAM E2960, ½ and 10+ spec.), sta. 58 (SAM E2961, 3 spec.), sta. 59 (SAM E2962, 2 spec.).

Distribution

The many specimens attributed to this assumed complex of subspecies come from almost all Subantarctic and Antarctic localities where collections have been made. Some specimens have been collected as far north as the vicinity of South Africa, south of Madagascar, and off South America and New Zealand. It has an enormous depth range (7–4900 m), suggesting rather definitely that more than one species is involved.

Remarks

Several subspecies were proposed for this species by Fry & Hedgpeth (1969:30–35) without adequate definition of each and with little information as a basis to separate them. The wide variation found in this genus would probably allow each subspecies to revert to its previously designated specific rank under further examination. The parent species, *C. megalonyx* Hoek, has a proboscis with little swelling and a length of little more to much longer than the trunk. One consistent character is in the palp where the eighth segment is shorter than the subequal ninth and tenth. The oviger does not have the subchelate structure of terminal spine and claw. There is very little else which conforms to a diagnosis of this species. A critical analysis of many specimens will be necessary to come to some conclusion regarding the presence or absence of valid species now found in this complex.

Colossendeis robusta Hoek, 1881

Colossendeis robusta Hoek, 1881: 66, pl. IX, figs. 4–5.– Child, 1995b: 72–73 [key], 89–90 [synonymy and literature].

Material examined

Sta. 46 (SAM E2963, 1 spec.), sta. 53 (SAM E2964, 1 spec.).

Distribution

The distribution for what is possibly another multiplicity of species under the name *C. robusta* is circumpolar in the enormous depth range of 0–3610 m.

Remarks

The most prominent characters in this species are the relatively short legs and short proboscis. The proboscis is slightly swollen medially, as long or little longer than the trunk, and the leg segments are shorter than most species in this genus. The femur and first tibia are subequal in length as are the tarsus and propodus. The distal palp segments are each unusually short, almost the same length, and armed with many tiny setae on all surfaces. The oviger strigilis lacks a chelate process of enlarged spine and claw.

Colossendeis scotti Calman, 1915

Colossendeis scotti Calman, 1915: 10 [key], 11–13, fig. 1.– Child, 1995b: 72–73 [key], 90, 92 [literature].

Material examined

Sta. 56 (SAM E2965, 1 spec.).

Distribution

This uncommon species has been collected in the vicinity of South Georgia, the South Sandwich and South Shetland Islands, Weddell Sea, and has the majority of captures located in the Ross Sea at moderate depths of 35–265 m.

Remarks

This is another species with a relatively short

proboscis, but it is widest in lateral view at the oral end and tapers toward the base. It is also quite inflated, being widest at its median length in dorsal view and constricted just before the flaring oral surface. Its eyes are darkly pigmented. The palp distal segments are quite short with the eighth shorter than the subequal ninth and tenth. The oviger strigilis has an enlarged terminal spine forming a subchelate structure with the claw. The legs are slender with the tarsus little longer than the propodus which has a long claw only slightly shorter than the propodus.

Colossendeis tortipalpis Gordon, 1932

Colossendeis tortipalpis Gordon, 1932: 12–15, figs. 2b–2e, 4a.– Child, 1995b:72–73 [key], 93 [literature].

Material examined

Sta. 53 (SAM E2966, 1 spec.).

Distribution

This species has one of the widest ranges in geographical distribution and depth of any Antarctic *Colossendeis* species. It has been collected off Tierra del Fuego, South America, off Heard Island in the southern Indian Ocean, the Scotia Sea and South Shetland Islands, and in many places in the Ross Sea. It has a vast depth range, like many *Colossendeis* species, of 44–4026 m.

Remarks

The distinctive characters of this species make it difficult to confuse with any other known Antarctic member of this genus except for *C. longirostris* Gordon, 1938. It has a very long proboscis (about 1.5 times trunk length) as in *C. longirostris*, but in this species it is downcurved with a much wider median inflation which tapers to a small oral surface. The palp has a long seventh segment, a triangular eighth segment, and the two longer distal segments are carried acutely recurved dorsally over the seventh and eighth. The oviger strigilis has a short terminal claw opposed by an enlarged distal spine on the terminal segment. There are several variations in its ocular tubercle and distal palp segments.

Colossendeis species indeterminate

Material examined

Sta. 60 (SAM E2967, 1 spec.).

Remarks

This specimen is very damaged and cannot be determined with any assurance.

Genus ***Decolopoda*** Eights

This genus contains the single species discussed below. It is the only 10-legged species among the Colossendeidae, at least in the Antarctic.

Decolopoda australis Eights, 1835
Fig. 2

Decolopoda australis Eights, 1835: 203–206, pl. VII.– Fry & Hedgpeth, 1969: 54–56 [early literature], Figs. 7, 8, 10, 75, 76, 78–82.– Child, 1995b: 94–95 [recent literature].

Material examined

Sta. 41 (SAM E2968, 1 spec.), sta. 42 (SAM E2969, 1 hirsute specimen), sta. 53 (SAM E2970, 1 spec.).

Distribution

This rather common species, the first Antarctic pycnogonid known, has been collected in many Subantarctic and Antarctic localities and has a circumpolar distribution. It is known from Heard Island in the southern Indian Ocean to the Ross Sea, and in a wide variety of depths from littoral to 1890 m.

Description of hirsute specimen

Entire specimen clothed in conspicuous but moderately short setae except anterior half of trunk and base of proboscis. The appendages are setose with the setae as long as but none longer than their segment diameters. Trunk setae cover the length of each lateral process in a field extending along entire dorsal surface of leg. Legs also with rows of lateral and ventral setae of various sizes. Ocular tubercle a small narrow cone with unpigmented eyes. Proboscis typical but with closely spaced setae covering all parts except base or proximal sixth of its length. Abdomen very long, slender, extending beyond second coxae distal rim of last leg pair, with dorsal field of short setae over entire length.

Cheliphores typical, with dorsal movable finger gaping above ventral immovable finger (unlike all other known pycnogonids except for following species). Both scape segments with field of dorsal

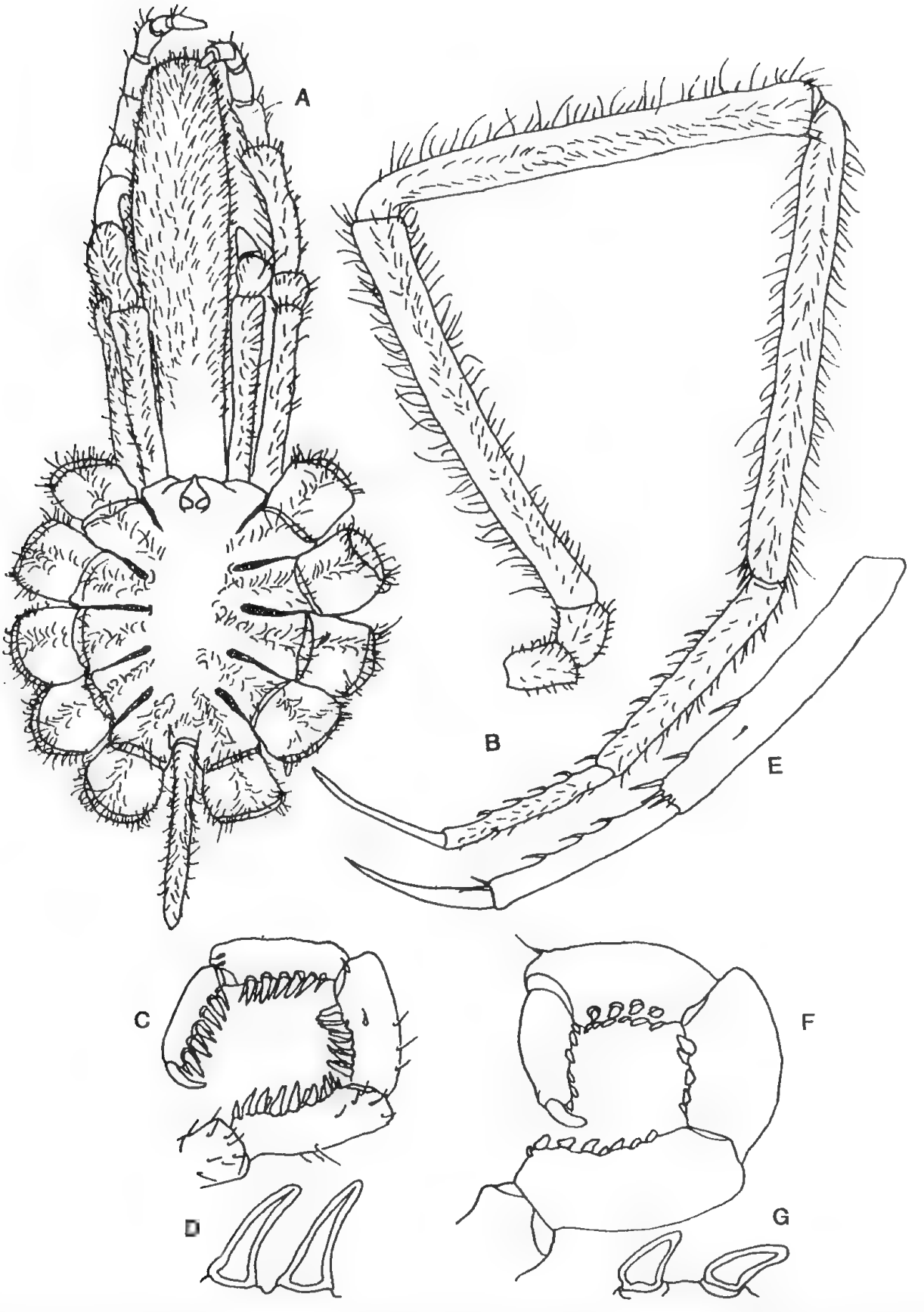

FIGURE. 2. *Decolopoda australis* Eights, the hirsute specimen: **A**, trunk, dorsal view; **B**, third leg; **C**, oviger strigilis, enlarged; **D**, two strigilis spines. Typical specimen: **E**, distal leg segments; **F**, oviger strigilis, enlarged; **G**, two strigilis spines.

setae along their lengths. Palps robust, proximal 5 segments with dorsal fields of setae, distal 5 segments with few ventral and lateral setae. Tenth segment a tapering rounded cone half length of ninth, glabrous. Ovigers decreasingly setose through their lengths. Strigilis segments slender, with rows of slightly curved plain spines each at least 3 times longer than wide. Terminal claw narrow, well curved, almost twice longer than segment diameter.

Legs slender, very setose in rows. Propodus 0.85 length of tarsus, both setose, with row of stout sole spines, but lacking ventrodistal spines. Claw very slender.

Remarks

This is the first specimen of this normally almost glabrous species to be described with extremely setose trunk, lateral processes, appendages, and proboscis. All specimens illustrated in the literature have very few setae. The differences between this specimen and typical examples of *Decolopoda australis*, besides the great number of setae, are found in the oviger strigils and the distal leg segments. The strigilis of a typical specimen is robust or even fat with very short broad plain spines, each well curved, pointing acutely distally, and little longer than their diameters. The terminal claw is shorter, measuring less than the segment diameter in length and there are only 2–3 ectal setae. The tarsus of a typical specimen is longer in relation to the propodus than that of this specimen and has fewer sole spines but does have ventrodistal spines on both segments. There are no setae on either segment of a typical specimen and the claw is usually stouter in comparison to the slender claw of this specimen. The terminal palp segment varies in typical specimens from being absent, a nub, a spike, or a full segment and is difficult to compare with the full segment of this hirsute specimen. This apparently unique specimen is possibly one of a population developing separately and might eventually become a new form, a variety, or even a new species. With the many variations known to occur in this species (causing it to have several synonyms over many years), it has maintained its status as a single species. The oviger and propodal differences are illustrated among the accompanying figures.

Genus ***Dodecolopoda*** Calman & Gordon

This is another genus, like the one above, with a single species which is discussed below. It is also the only 12-legged species in this collection.

Dodecolopoda mawsoni Calman & Gordon, 1933

Dodecolopoda mawsoni Calman & Gordon, 1933: 107–115, fig. 1.– Child, 1995b: 95 [literature].

Material examined

Sta. 53 (SAM E2971, 1 spec.), sta. 57 (SAM E2972, 1 spec.).

Distribution

There are probably no more than six specimens of this rare species listed in the literature, but from these scattered records, its known distribution is probably circumpolar. It is known from the South Shetland Islands, Palmer Archipelago, the Ross Sea, and in Enderby Land at 62°E. Known capture depths are 146–549 m.

Remarks

This is the first record known with two specimens of this species in one report. This is the only pycnogonid known with the paired characters of twelve legs and giant size and therefore is easily recognized. The only other known Antarctic species with twelve legs, *Sexanymphon mirabilis* Hedgpeth & Fry, 1964, is quite small.

This species is closely related to *Decolopoda australis*, and is the only other pycnogonid known with tong-like chelae having the movable finger dorsal to the immovable finger rather than a movable finger in the almost universal ventral position. Both have closely crowded lateral processes creating a circular or ovoid trunk in dorsal aspect. The long proboscis of both is distally inflated and downcurved, the legs are moderately long, the tarsus is much longer than the propodus with its shorter claw. The legs of this species are fairly setose in rows while those of *Decolopoda australis* are almost glabrous with only a few scattered spines. The size of the two specimens in hand is perhaps twice as large as specimens of *D. australis*, although size alone is not a diagnostic character.

Family CALLIPALLENIDAE Hilton

This is a diverse family with many genera, most having few species. They all share the characters of full cheliphores and chelae with fingers, often

with teeth, a lack of palps or palps of a single blunt segment, and ovigers in both sexes, with 10 segments and no terminal claw (except in genera not found in Antarctica). Only two genera were collected in Prydz Bay.

Genus *Austropallene* Hodgson, 1915

Both palps and auxiliary claws are entirely lacking in this genus. The proboscis is styliform or narrow and very tapered distally. The cheliphores are usually large to giant with the scapes tuberculate or smooth and the chelae fingers without teeth but sometimes with 1-2 notches. The trunk lacks dorsal architecture.

Austropallene brachyura (Bouvier, 1911)

Pseudopallene brachyura Bouvier, 1911: 1138.

Austropallene brachyura.– Calman, 1915: 39.– Child, 1995c: 132 [literature].

Material examined

Sta. 40 (SAM E2973, 1♂); sta. 54 (SAM E2974, 1♂).

Distribution

This is a circumpolar species known from moderate depths to 640 m.

Remarks

This is one of the more common species of this Subantarctic-Antarctic genus which contains only seven species. It is separable from others by its proboscis, a proximal cylinder with a distal cone, and small cheliphores without distal tubercles on the scapes, chelae fingers of subequal length, and smooth legs with few setae only. Gordon (1944: 36–37) provided a useful key to six of the seven species.

Austropallene calmani Gordon, 1944

Austropallene calmani Gordon, 1944: 42–45, figs. 12a, 13a–c, 14a.– Child, 1995c: 132–133.

Material examined

Sta. 45 (SAM E2975, 1♂); sta. 46 (SAM E2976, 1♂).

Distribution

Its scattered capture localities around the Antarctic perimeter make this another circumpolar species. It has been found in 163–2966 m.

Remarks

This species has a very narrow proboscis which is predominantly a cylinder. It has a small distal cone at the oral surface. The cheliphore scapes have 2–3 large dorsal tubercles and the chaela have fingers of different lengths. The immovable finger has two distal lobes into which the movable finger tip inserts. The legs have tiny tubercles bearing setae. There appears to be little variation in both this species and all others of the genus.

Austropallene cornigera (Möbius, 1902)

Pseudopallene cornigera Möbius, 1902: 186–187.

Austropallene cornigera.– Gordon, 1932: 85–86 [early literature], figs. 42–43.– Child, 1995c: 133–134 [recent literature].

Material examined

Sta. 47 (SAM E2977, 1♂).

Distribution

This extremely common circumpolar species has a moderate depth range of 90–550 m.

Remarks

This is the only species in this limited genus with giant cheliphores larger than its trunk. The immovable finger has an endal notch. The proboscis is widest at its base and tapers to a tiny distal tube. The trunk has small to large dorsomedian tubercles but they are lacking on the cheliphore scapes.

Genus *Pallenopsis* Wilson

Subgenus *(Pallenopsis)* Stock, 1975

This genus of many species has two subgenera; the first with larger numbers of more common species usually found in shallower waters, and the second with fewer deeper water species. Each has its own set of unique diagnostic characters not shared by the other subgenus. The genus *Pallenopsis* has 1-segmented palp buds, a short neck carrying ocular tubercle and cheliphores and extending dorsally over the top of the usually short proboscis. The cheliphores are sometimes 2-segmented but are progressing toward the loss of

the segmentation line dividing the two segments. The chelae are fully formed and functional. Ovigers are 10-segmented, without a terminal claw, and sometimes are only 9-segmented in females. The legs are moderately long and sometimes very long, and the male femoral cement gland is ventral and usually exits through a slender tube of varying length among the species. The propodus has auxiliary claws which are sometimes long.

The subgenus *Pallenopsis* has chelae with short fingers placed anaxially or at a right angle to the usually rectangular palm. The movable finger usually has a basal setose bump or pad in the male which is reduced in size or lacking in females. The proboscis in this subgenus is usually shorter than those of the other subgenus, *Bathypallenopsis*, and some species in this subgenus are extremely setose with some of these species having tiny lateral setules on each long seta. These setose species are almost all confined to Antarctic and Subantarctic localities. Only one has so far been collected in Prydz Bay for inclusion in this report.

Pallenopsis* (*Pallenopsis*) *patagonica (Hoek, 1881)

Phoxichilidium patagonicum Hoek, 1881: 84–86, pl. 12, figs. 6–9.

Pallenopsis patagonica.– Loman, 1923: 34.– Child, 1995c: 147–149 [literature].

Material examined

Sta. 25B (SAM E2978, 2♂); sta. 41 (SAM E2979, 3♀); sta. 42 (SAM E2980, 3♀); sta. 45 (SAM E2981, 1 juv.); sta. 46 (SAM E2982, 1♀); sta. 49 (SAM E2983, 1♂ with eggs, 1♂, 1♀).

Distribution

This is a circumpolar species found on all coasts and the deeps of Antarctica and the Subantarctic. It has an extremely wide depth range of 254–3566 m.

Remarks

This species comes close to *P.* (*P.*) *villosa* Hodgson, in being the most setose species in the subgenus *Pallenopsis*. The trunk and appendages sometimes cannot be seen for the extensive field of long setae covering its dorsal surface. The crowded setae are always plain and have no lateral setules as do those of *P.* (*P.*) *villosa*, so that the trunk shape and widely spaced lateral processes can usually be seen among the many long setae. The plain setae constitute a good diagnostic character and they are easily examined for this purpose.

Pallenopsis* (*P.*) *pilosa (Hoek, 1881)

Phoxichilidium pilosum Hoek, 1881: 90, pl. 13, figs. 10–13.

Pallenopsis pilosa Hoek, 1883: 9 [list].– Child, 1995c: 149–150 [literature].

Material examined

Sta. 41 (1♂, SAM E2984); sta. 42 (1 juv. SAM E2985); sta. 44 (1♂, with eggs, 1♂, 2♀, 1 juv., SAM E2986); sta. 45 (1♀, SAM E2987); sta. 46 (1 juv., SAM E2988); sta. 47 (3♂, 3♀, SAM E2989); sta. 49 (1♂, 2♀, SAM E2990); sta. 52 (1♂, 8♀, 1 juv., SAM E2991); sta. 53 (1♂, 4♀, SAM E2992); sta. 54 (5♂, 4♀, SAM E2993).

Distribution

This is also a circumpolar species, but it has an extremely wide depth range of 254–3566 m.

Remarks

This is one of the most setose species in the subgenus *Pallenopsis*. With the species *P.* (*P.*) *villosa* Hodgson, 1907, the trunk and appendages sometimes cannot be seen for the extensive field of long setae covering its dorsal surfaces. The multitude of setae each have many lateral setules which greatly contribute to its camouflage. This species comes close to *villosa*, but the shape of the trunk and widely spaced lateral processes can always be discerned behind the many long setae. These setae are plain and have no lateral setules, a consistent diagnostic character easily seen.

Family NYMPHONIDAE Wilson

The largest family among the nine families of Pycnogonida, this one boasts a bewildering array of some 250 species, mostly concentrated in the vast genus *Nymphon*. Many of these species fall into somewhat natural groups which are currently being recognized and used to segregate at least some of the array into manageable subsets for identification purposes. There are several other small genera in this family, only one of which was collected in Prydz Bay.

Genus *Nymphon* Fabricius, 1794

Nymphon species are often collected in large numbers from any trawl, particularly in Antarctic waters. They are characterized by having fully chelate cheliphores, palps of five segments beginning with a short first segment, fully segmented trunks with an ocular tubercle and eyes, 10-segmented ovigers in both sexes, each oviger having a fully formed strigilis with leaf-shaped denticulate inner spines and a terminal claw bearing teeth. Most shallow-water species have auxiliary claws of various lengths and more of the deep water species than not have a simple main claw without auxiliaries (for unknown reasons). Three *Nymphon* species are represented in these collections.

Nymphon australe Hodgson, 1902

Nymphon australe Hodgson, 1902: 257, pl. XI.– Gordon, 1932: 59–60 [early synonymy and literature], figs. 25d, 26b.– Child, 1995a: 9–10 [recent literature].

Material examined

Sta. 41 (SAM E2994, 1♂, 1♀); sta. 42 (SAM E2995, 1 juv.); sta. 44 (SAM E2996, 27 spec.); sta. 45 (SAM E2997, 19 spec.); sta. 46 (SAM E2998, 10 spec.); sta. 47 (SAM E2999, 5 spec.); sta. 52 (SAM E3000, 10 spec.); sta. 53 (SAM E3001, 6 spec.); sta. 54 (SAM E3002, 5 spec.); sta. 55 (SAM E3003, 3 spec.); sta. 57 (SAM E3004. 1♀); sta. 59 (SAM E3005, 1 juv.); sta. 60 (SAM E3006, 1♂, 1♀); sta. 61 (SAM E3007, 1♀).

Distribution

This species is the most commonly captured pycnogonid in Antarctic and Subantarctic waters and appears in almost every report on specimens from those waters. It has been collected as far north as Cook Strait, New Zealand, the Falkland Islands, Chilean and Argentine coasts, and some Subantarctic localities in the Indian Ocean in depths of usually less than 2000 m.

Remarks

This most common species serves as the pattern for the *Australe* group (Child, 1995a:5, 6–7 [key]) of related species in this, the largest pycnogonid genus. The group is diagnosed by a robust trunk with crowded lateral processes and a short neck which is crowded laterally with oviger bases. The trunk and lateral processes of this group of 20 described species usually have conspicuous dorsal setae or spines or both and a swollen abdomen carried horizontally. The cheliphores usually have conspicuous spines or setae only on the inner lateral surfaces. Another steady character is found in the male ovigers which almost always have fifth and sixth segments which are distally inflatable with the inflated area usually collapsed. On the legs, the tibiae and tarsus have a few long ventrodistal spines, the tarsus is as long or longer than the propodus, both are often straight and have short evenly spaced sole spines. Auxiliary claws can be absent, vestigial, or shorter than the main claw diameter, and are never longer. No other group of *Nymphon* species from the Antarctic (or any other body of water) share most of these characters. To compare morphologies, a closely related variety, *N. australe* var. *caecum* Gordon, 1944, shares all these characters but one. It is the deep-water congener of the parent species and only lacks eyes and an ocular tubercle, both of which are conspicuous and tall in *N. australe*.

Nymphon charcoti Bouvier, 1911

Nymphon charcoti Bouvier, 1911: 1138.– Child, 1995a: 35–37 [literature].

Material examined

Sta. 41 (SAM E3008, 1♂); sta. 45 (SAM E3009, 1 juv.); sta. 46 (SAM E3010, 1 juv.); sta. 52 (SAM E3011, 2♂, 1♀); sta. 53 (SAM E3012, 7 spec.); sta. 54 (SAM E3013, 3 juv.).

Distribution

This species is collected much less often than the last species listed but probably has a circumpolar range in 150–1080 m, where it appears to be common where found.

Remarks

This is the largest known species of *Nymphon* in Antarctic waters (*N. inferum* Child, 1995a, almost reaches this size). The trunk of *N. charcoti* often measures 18+ mm in length, while that of *N. inferum* has a maximum known length of about 15 mm. Both species are quite a bit larger than the average *Nymphon*.

There is a small ventrodistal knob on the anterior of the cephalic segment opposite the ocular tubercle and the short ocular tubercle has large pigmented eyes in this species. The ocular

area of *N. inferum* has a low bump and lacks eyes entirely. The tarsus is longer than the propodus in this species while it is shorter in *N. inferum*. There are a good number of similar characters in the two species besides adult size but those listed above will serve to differentiate the species.

Nymphon gracilipes Miers, 1875

Nymphon gracilipes Miers, 1875: 76.– Child, 1995a: 38–39 [literature].

Material examined

Sta. 48 (SAM E3014, 1♀); sta. 59 (SAM E3015, 1♀); sta. 60 (SAM E3016, 1♀).

Distribution

This species has been collected most often in the Indian Ocean quadrant of the Antarctic and in the Subantarctic islands to the north. It has a broad depth range of 20–1000 m, with one capture reported in 3055 m which may be either an identification or recording error.

Remarks

This clean-appearing species has a long glabrous trunk and well separated lateral processes with the same tenuosity found in the cheliphores, ovigers, and legs. The tarsus is 0.3 times longer than the propodus and the main claw is short with auxiliary claws only 0.4 as long as the main claw.

Genus ***Pentanymphon*** Hodgson

A very small sized species of *Nymphon* which has over time developed an extra trunk segment and an extra pair of legs making 10 in all. There is a single common species in this genus although it has sufficient variation to have caused an expanded synonymy since it was described.

Pentanymphon antarcticum Hodgson, 1904

Pentanymphon antarcticum Hodgson, 1904: 458–462, pl. XIV.– Child, 1995a: 54–55 [literature].

Material examined

Sta. 57 (SAM E3017, 1♀).

Distribution

This common species has been collected in many localities in the vicinity of 200 m, but has a scattering of other captures in depths as deep as 3227 m. It has a circumpolar distribution.

Remarks

This small species is usually very white coloured and is one of the rare pycnogonids with five pairs of legs. Its lateral processes are well separated and glabrous, the ocular tubercle and oviger bases are placed to the anterior of the first lateral processes on a long neck, and the slender long legs have few short setae.

Family PYCNOGONIDAE Wilson

This is probably the most morphologically advanced family in the pycnogonids, if advanced means loss of or reduction of segments and appendages. The species of this family and genus lack any form of cheliphores or palps, and some species have even disposed of ovigers. The males of these anovigerous species merely cement the egg clusters to their ventral trunk surfaces. Many species have also abandoned auxiliary claws or these claws are so vestigial as to be nonfunctional. The species are almost all robust with short lateral processes and very short legs with the second tibiae sometimes shorter than their diameters.

Genus ***Pycnogonum*** Brünnich, 1764

Pycnogonum species indeterminate

Material examined

Sta. 41 (SAM E3018, 1 larva).

Remark

This specimen is too young to be determined except to its genus.

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Appendix

Stations and Species from Prydz Bay, Antarctica,
Collected on R/V 'Aurora Australis', 1991

Sta. 25B, 68°31.1'S, 77°29.4'E, 251–416 m (bottom 450–556 m) 3 II	
Achelia spicata (Hodgson)	1♀
Pallenopsis (*P.*) *patagonica* (Hoek)	2♂
Sta. 40, 67°01.1'S, 78°11.5'E, 251–260 m, trawl, 17 II	
Colossendeis megalonyx ssp. Fry & Hedgpeth	2 spec.
Austropallene brachyura Hodgson	1♂
Sta. 41, 67°30.6'S, 77°14.3'E, 333–341 m, trawl, 18 I	
Colossendeis adelpha, new species	1 spec.
Colossendeis drakei Calman	1 spec.
Colossendeis megalonyx ssp. Fry & Hedgpeth	1 spec.
Decolopoda australis Eights	1 spec.
Pallenopsis (*P.*) *patagonica* (Hoek)	3♀
Pallenopsis (*P.*) *pilosa* (Hoek)	1♂
Nymphon australe (Hodgson)	1♂, 1♀
Nymphon charcoti Bouvier	1♂
Pycnogonum sp. indet.	1 larva
Sta. 42, 67°34.–'S, 77°33.–'E, 300 m, trawl, 18 II	
Decolopoda australis Eights	1 hirsute spec.
Pallenopsis (*P.*) *patagonica* (Hoek)	3♀
Pallenopsis (*P.*) *pilosa* (Hoek)	1 juv.
Nymphon australe (Hodgson)	1♀
Sta. 43, 67°57.5'S, 76°20.6'E, 436–441 m, trawl, 19 II	
Colossendeis drakei Calman	1 spec.
Sta. 44, 68°27.9'S, 75°26.6'E, 616–622 m, trawl, 19 II	
Ammothea spinosa (Hodgson)	3♂, 3♀, 3 juv.
Colossendeis megalonyx ssp. Fry & Hedgpeth	3 juv.
Pallenopsis (*P.*) *pilosa* (Hoek)	1♂ w/ eggs, 1♂, 2♀, 1 juv.
Nymphon australe (Hodgson)	27 spec.
Sta. 45, 68°58.3'S, 74°23.8'E, 787 m, trawl, 19 II	
Ammothea spinosa (Hodgson)	1♂ (damaged)
Colossendeis drakei Calman	1 juv.
Austropallene calmani Gordon	1♂
Pallenopsis (*P.*) *patagonica* (Hoek)	1 juv.
Pallenopsis (*P.*) *pilosa* (Hoek)	1♀
Nymphon australe (Hodgson)	19 spec.
Nymphon charcoti Bouvier	1♂ juv.
Sta. 46, 68°31.7'S, 73°13.0'E, 743 m, trawl, 20 II	
Colossendeis drakei Calman	1 spec.
Colossendeis megalonyx ssp. Fry & Hedgpeth	4 spec.
Colossendeis robusta Hoek	1 spec.
Austropallene calmani Gordon	1♂
Pallenopsis (*P.*) *patagonica* (Hoek)	1♀
Pallenopsis (*P.*) *pilosa* (Hoek)	1 juv.
Nymphon australe (Hodgson)	5 spec.
Nymphon charcoti Bouvier	1♂
Sta. 47, 68°23.1'S, 73°48.4'E, 660–662 m, trawl, 21 II	
Austroraptus polaris Hodgson	1♀
Austropallene cornigera Möbius	1♂

Pallenopsis (*P.*) *pilosa* (Hoek)	3♂, 3♀
Nymphon australe (Hodgson)	5 spec.
Sta. 48, 68°03.7'S, 73°09.3'E, 680–683 m, trawl, 21 II	
Colossendeis megalonyx ssp. Fry & Hedgpeth	1 spec.
Nymphon gracilipes Miers	1♀
Sta. 49, 66°59.5'S, 76°26.7'E, 327–332 m, trawl, 22 II	
Colossendeis australis Hodgson	1 spec.
Pallenopsis (*P.*) *patagonica* (Hoek)	1♂ w/eggs, 1♂, 1♀
Pallenopsis (*P.*) *pilosa* (Hoek)	3 spec.
Sta. 52, 66°46.4'S, 72°36.5'E, 530 m, trawl, 24 II	
Ammothea adunca Child	1♂
Ammothea allopodes Fry & Hedgpeth	1♂, 2♀
Ammothea glacialis (Hodgson)	1♂
Colossendeis megalonyx ssp. Fry & Hedgpeth	6 spec.
Pallenopsis (*P.*) *pilosa* (Hoek)	1♂, 8♀, 1 juv.
Sta. 53, 66°03.7'S, 72°36.2'E, 526–532m, trawl, 24 II 91	
Ammothea glacialis (Hodgson)	1♂ w/eggs, 1♀
Ammothea spinosa (Hodgson)	1♂ w/eggs, 1♀
Colossendeis australis (Hodgson)	1 spec.
Colossendeis drakei Calman	6 spec.
Colossendeis megalonyx ssp. Fry & Hedgpeth	20+ spec.
Colossendeis robusta Hoek	1 spec.
Colossendeis tortipalpis Gordon	1 spec.
Decolopoda australis Eights	1 spec.
Dodecolopoda mawsoni Calman & Gordon	1 spec.
Pallenopsis (P.) pilosa (Hoek)	1♂, 4♀
Nymphon australe (Hodgson)	6 spec.
Nymphon charcoti Bouvier	1♂ w/eggs, 4♀, 2 juv.
Sta. 54, 67°00.3'S, 72°40.2'E, 532–536m, trawl, 24 II 91	
Ammothea glacialis (Hodgson)	1♀
Colossendeis megalonyx ssp. Fry & Hedgpeth	12½ spec.
Austropallene brachyura Hodgson	1♂
Pallenopsis (P.) pilosa (Hoek)	5♂, 4♀
Nymphon australe (Hodgson)	5 spec.
Nymphon charcoti Bouvier	3 juv.
Sta. 55, 66°43.6'S, 71°54.5'E, 667–676 m, trawl, 25 II	
Nymphon australe (Hodgson)	3 spec.
Sta. 56, 67°27.5'S, 70°20.2'E, 161–165 m, trawl, 26 II	
Colossendeis scotti Calman	1 spec.
Sta. 57, 67°16.7'S, 70°08.1'E, 172–182 m, trawl, 26 II	
Colossendeis australis Hodgson	1 spec.
Dodecolopoda mawsoni Calman & Gordon	1 spec.
Nymphon australe (Hodgson)	1 spec.
Pentanymphon antarcticum Hodgson	1 spec.
Sta. 58, 67°02.4'S, 70°18.8'E, 242–244 m, trawl, 26 II	
Colossendeis drakei Calman	3 spec.
Colossendeis megalonyx ssp. Fry & Hedgpeth	3 spec.
Sta. 59, 66°53.4'S, 70°40.5'E, 444–453 m, trawl, 27 II	
Colossendeis megalonyx ssp. Fry & Hedgpeth	2 spec.
Nymphon australe (Hodgson)	1 juv.
Nymphon gracilipes Miers	1♀

Sta. 60, 67°16.3'S, 68°57.7'E, 139 m, trawl, 28 II

Colossendeis sp. indet.	1 damaged spec.
Nymphon australe (Hodgson)	1♂, 1♀
Nymphon gracilipes Miers	1♀

Sta. 61, 67°27.4'S, 68°50.3'E, 145–150 m, trawl, 1 III

Austrodecus glaciale Hodgson	1 spec.
Colossendeis australis Hodgson	11 spec.
Nymphon australe (Hodgson)	1 spec.

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SELECTION OF LECTOTYPES AND REDESCRIPTIONS OF THREE CISSEIS (COLEOPTERA : BUPRESTIDAE) SPECIES

SHELLEY BAKER

Summary

Carter (1923) described C. elliptica var. frontalis, recognised by Obenberger (1935) as a primary homonymn of C. frontalis Kerremans and replaced with C. carterella. Carter (1940) synonymised C. carteri Obenberger with C. elliptica Carter. Examination of the types and a series of all three taxa shows that they are all good species. Lectotypes of the three species are selected.

SELECTION OF LECTOTYPES AND REDESCRIPTIONS OF THREE *CISSEIS* (COLEOPTERA: BUPRESTIDAE) SPECIES

SHELLEY BARKER

BARKER, S. 1998. Selection of lectotypes and redescriptions of three *Cisseis* (Coleoptera: Buprestidae) species. *Records of the South Australian Museum* **31**(1): 21–23.

Carter (1923) described *C. elliptica* var. *frontalis,* recognised by Obenberger (1935) as a primary homonym of *C. frontalis* Kerremans and replaced with *C. carterella.* Carter (1940) synonymised *C. carteri* Obenberger with *C. elliptica* Carter. Examination of the types and a series of all three taxa shows that they are all good species. Lectotypes of the three species are selected.

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Material

Specimens examined came from the following institutions:

ANIC – Australian National Insect Collection, Canberra.
AMSA – Australian Museum, Sydney.
NMPC – National Museum Prague, Czech Republic.
NMVA – National Museum of Victoria, Melbourne.
QMBA – Queensland Museum, Brisbane.
SAMA – South Australian Museum, Adelaide.

Sub-Species Elevated To Species And Selection Of Lectotypes

Obenberger (1935) recognised *Cisseis elliptica* var. *frontalis* Carter, 1923 as a primary homonym of *Cisseis frontalis* Kerremans, 1898 and published the replacement name *C. carterella. C. elliptica* Carter is an arid zone Western Australian species, while *C. carterella* is found in mountainous areas in northern Queensland. A comparison of the two forms shows clearly that they are separate species on the basis of differences in morphology, male genitalia (Fig. 1) and distribution.

Carter (1923) described the taxon from two specimens, one from Kuranda, Dodd, in his own collection and the other from Herberton in QMBA. I have located the two syntypes, both are female. One is held by QMBA the other by NMVA. I hereby select the female specimen in QMBA labelled 'Herberton. C. J. Wild. Jan 91. c/2712' as the lectotype of *Cisseis carterella* Obenberger, 1935.

Two syntypes of *C. carteri* Obenberger are in NMPC. I hereby select male specimen no. 23769, Yilgarn, Western Australia as the lectotype of *Cisseis carteri* Obenberger, 1933.

Carter (1923) based his description of *Cisseis elliptica* on two specimens collected by H. W. Brown at Cue and Tenindewa. A female specimen labelled *'C. elliptica* Carter, Cue, W.A., H. W. Brown, Cotype', is lodged in the collection of the National Museum of Victoria. I hereby select this specimen as the lectotype of *C. elliptica* Carter.

Description Of Species

Cisseis carterella Obenberger, 1935
(Fig. 1 C)

Cisseis elliptica var. *carterella* Obenberger, 1935: 846 replacement name for *Cisseis elliptica* var. *frontalis* Carter, 1923, homonym of *C. frontalis* Kerremans, 1898.

Type

Lectotype: ♀, Herberton, Jan. 91, C. J. Wild, QMBA; *Paralectotype:* ♀, Kuranda, Dodd, NMVA.

Colour

Head, antennae, pronotum, scutellum ventral surface and legs shiny bronze. Elytra dark brown. Hairs white.

Shape and sculpture

Head with deep anterior median fovea; deep punctures becoming shallow posteriorly, most with single emergent seta; interocular width 0.6

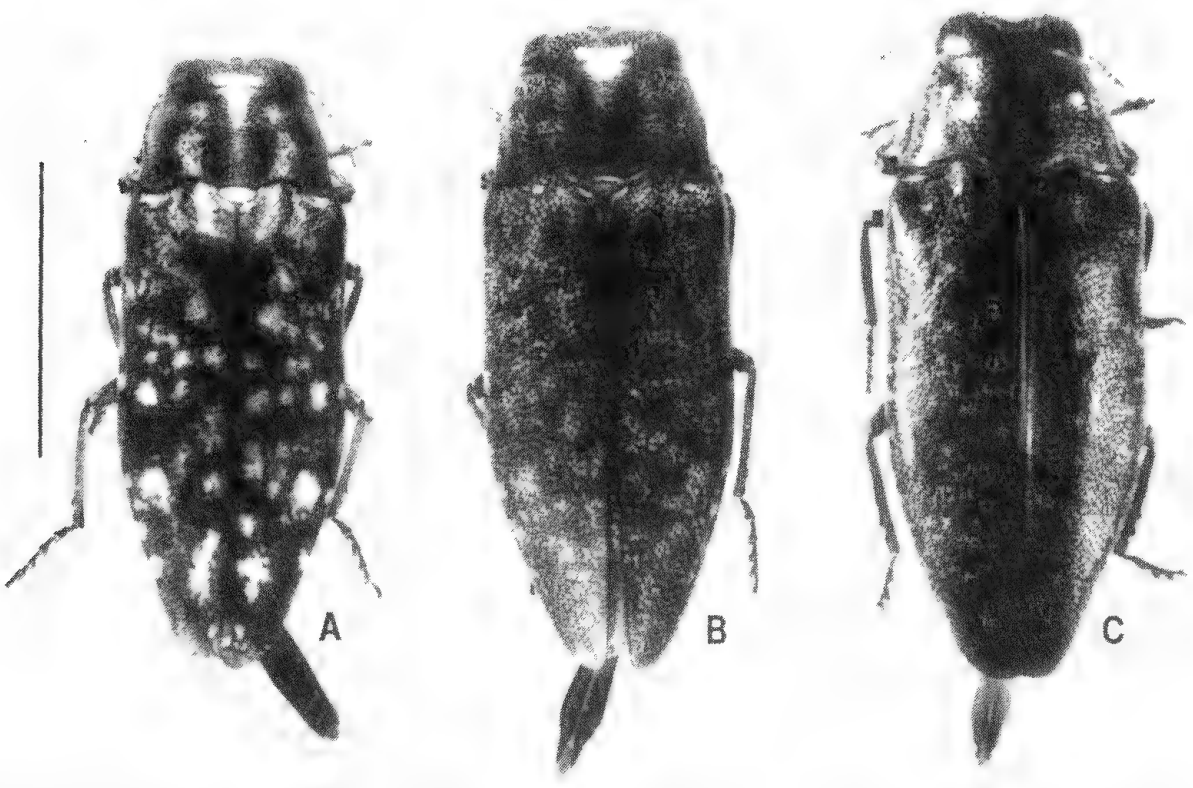

FIGURE 1. Habitus photographs of the following *Cisseis* species. **A**, *C. carteri* Obenberger. **B**, *C. elliptica* Carter. **C**, *C. carterella* Obenberger. Scale bar = 5mm.

head width. Antennae: antennomeres 1–3 obconic; 4–11 toothed. Pronotum: anterior margin projecting medially, basal margin sinuate; medially glabrous with shallow punctures; laterally, most punctures with single emergent seta lying in sinuous striae; dorsal carina diverging from ventral carina at base and then parallel to it, reaching apical margin, space between punctured, most punctures with emergent seta. Scutellum scutiform, laterally elongate at basal margin, glabrous, surface convex with few shallow punctures. Elytra heavily punctate with irregular clumps of hairs mostly in single row widely scattered over the surface; prominent humeral callus, apices rounded, apical margin sub-serrate. Ventral surface shallowly punctured, hairy but less so in the mid-ventral line.

Aedeagus

In *C. elliptica* (Fig. 1 B) the parameres are laterally indented just before apex and have a membranous lateral apical flange. In *C. carterella* (Fig. 1 C) the parameres are rounded laterally to apex without an apical flange.

Size

Males 11.7 x 4.7 mm (10). Females 13.2 x 5.2 mm (5)

Distribution

Queensland: Kuranda, Herberton, Mt Spec, Maryborough.

Cisseis carteri Obenberger, 1924
(Fig. 1 A)

Cisseis carteri Obenberger, 1924: 109.

Cisseis elliptica Carter, 1940: 389.

Type

Lectotype: ♂, NMPC no. 23 769, Yilgarn, W. Australia; *Paralectotype:* ♂, NMPC no. 23 770, Yilgarn, Western Australia.

Colour

Head coppery-bronze; hairs silver, rounded in males, flattened and broad in females. Antennae coppery-bronze. Pronotum bronze medially, coppery-bronze laterally; hairs flattened and broad in both sexes, in a medial column on each side diverging outwards as a basal elongate mark and a discrete round mark apically, along the upper edge of the dorsal carina and around the angle and the interval between dorsal and ventral carina. Scutellum bronze. Elytra bronze with broad flattened hairs mainly forming a large number of

small rounded spots but with a pair of elongate basal marks continuing on from thoracic line. Ventral surface and legs coppery-bronze.

Shape and sculpture

Head closely punctured, hairy, flat without medial fovea, interocular width 0.6 head width. Antennae: antennomeres 1–3 obconic; 4–11 toothed. Pronotum shallowly punctured medially, punctures deeper laterally and arranged in sinuous striae; anterior margin projecting medially, basal margin sinuate; upper carina glabrous and flattened diverging from lower carina at base then more or less parallel to it, diverging just before reaching the apical margin, interval punctured and with flattened hairs. Scutellum scutiform, basal margin convex, expanded laterally, few shallow punctures, glabrous. Elytra punctured below humeral callus and above to the pre-medial area, punctures arranged in sinuous striae, remaining part heavily wrinkled to the apex; rounded at apex; apical margin sub-serrate. Ventral surface with dense flattened hairs laterally, glabrous medially, shallowly punctured.

Size

Males, 11.4 x 4.1 mm (10). Females, 13.6 x 5.0 mm (5).

Aedeagus

Parameres heavily chitinised, more or less parallel-sided.

Distribution

Western Australia: Wurarga, Dedari.

Cisseis elliptica Carter, 1923
(Fig. 1 B)

Cisseis elliptica Carter, 1923: 170.

Type

Lectotype: ♀, Cue, W. A., H. W. Brown, NMVA; *Paralectotype*: ♂ Tendindewa, H. W. Brown, AMSA.

Colour

Head bronze, clypeus coppery. Antennae bronze with coppery reflections. Pronotum, scutellum, elytra, ventral surface and legs bronze. Hairs silver.

Shape and sculpture

Head flat, deep punctures anteriorly, becoming shallow posteriorly each with individual seta, narrow median glabrous line free of punctures on basal half; interocular width 0.7 head width. Antennae: antennomeres 1–3 obconic; 4–11 toothed. Pronotum with shallow punctures, laterally arranged in sinuous striae each with individual seta; apical margin projecting medially, basal margin sinuate; dorsal carina glabrous, diverging from ventral carina basally converging before reaching apical margin, interval punctured, each puncture with an individual seta. Scutellum scutiform, laterally expanded, basal margin convex, punctured. Elytra punctured under and over humeral callus and along suture to middle, remainder wrinkled; small clumps of bifurcate hairs (lower shorter part flat, upper longer and round) forming irregular patterns; apically rounded; apical margin sub-serrate. Ventral surface with shallow punctures each with individual seta.

Size

Males, 11.4 x 4.3 mm (6). Females, 11.8 x 4.5 mm (11).

Aedeagus

Parameres elongate, narrow with a lateral apical flange on each side. Ventral valve excised in males.

Distribution

Western Australia: Cue, Dedari, Tammin, Wurarga, Leonora.

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THE SPECIES OF ANTROPORA NORMAN, 1903 (BRYOZOA : CHEILOSTOMATIDA), WITH THE DESCRIPTION OF A NEW GENUS IN THE CALLOPOROIDEA

KEVIN J. TILBROOK

Summary

The cheilostomate bryozoan genus Antropora was introduced by Norman (1903b) for Membranipora granulifera Hincks, 1880a. The need for a review of the genus Antropora became apparent during the course of a current study of reef-associated bryozoans collected from localities in the south-west Pacific. This paper redescribes Antropora granulifera (Hincks, 1880a) and stabilises the taxon through the selection of a neotype specimen. In all, seven species of Antropora are described and figured: A. granulifera, A. minor, A. subvespertilio, A. tincta, A. marginella, A. typica and A. erectirostra new species. The type species Parantropora is introduced and distinguished from Antropora. The type species Parantropora penelope new species is described, together with the new combination, P. laguncula. Two further species, Retevirgula aggregata and Crassimarginatella papulifera, are described from material originally assigned to a species of Antropora. The classification of Antropora and Parantropora is discussed in relation to several calloporoidean families.

THE SPECIES OF *ANTROPORA* NORMAN, 1903 (BRYOZOA: CHEILOSTOMATIDA), WITH THE DESCRIPTION OF A NEW GENUS IN THE CALLOPOROIDEA

KEVIN J. TILBROOK

TILBROOK, K. J. 1998. The species of *Antropora* Norman, 1903 (Bryozoa: Cheilostomatida), with the description of a new genus in the Calloporoidea. *Records of the South Australian Museum* **31**(1): 25–49.

The cheilostomate bryozoan genus *Antropora* was introduced by Norman (1903b) for *Membranipora granulifera* Hincks, 1880a. The need for a review of the genus *Antropora* became apparent during the course of a current study of reef-associated bryozoans collected from localities in the south-west Pacific. This paper redescribes *Antropora granulifera* (Hincks, 1880a) and stabilises the taxon through the selection of a neotype specimen. In all, seven species of *Antropora* are described and figured: *A. granulifera*, *A. minor*, *A. subvespertilio*, *A. tincta*, *A. marginella*, *A. typica* and *A. erectirostra* new species. The new genus *Parantropora* is introduced and distinguished from *Antropora*. The type species *Parantropora penelope* new species, is described, together with the new combination, *P. laguncula*. Two further species, *Retevirgula aggregata* and *Crassimarginatella papulifera*, are described from material originally assigned to a species of *Antropora*. The classification of *Antropora* and *Parantropora* is discussed in relation to several calloporoidean families.

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The cheilostomate bryozoan genus *Antropora* was introduced by Norman (1903b) for *Membranipora granulifera* Hincks, 1880a, described originally from Madeira. Norman (1903b) was clearly familiar with Hincks' species, noting that it was commonly dredged from shell gravel off Madeira, at depths of 70–100 fathoms. *Antropora granulifera* forms encrusting unilaminar sheets; autozooids display a simple morphology, with negligible gymnocyst, moderate cryptocyst and lack spines. Small interzooidal avicularia are present; embryos are brooded in endozooidal ovicells and interzooidal communication is achieved through basal pore chambers.

Harmer (1926) was the first modern authority to make use of *Antropora* Norman, describing *A. granulifera* from material collected in the Indo-Malaysian region by the 'Siboga' Expedition (1899–1900). Harmer reviewed published records of *Membranipora granulifera* Hincks, and showed its distribution to range from Madeira and the Cape Verde Islands (Calvet 1907), to the Red Sea (Waters 1898), Sri Lanka and southern India (Thornely 1905; 1912). *Membranipora marginella* Hincks, 1884, from the Mergui Archipelago, west Thailand and also recorded subsequently from the Red Sea (Waters 1898), was also assigned to *Antropora* by Harmer (1926). Canu and Bassler (1929) published a generic diagnosis of *Antropora* based on the work of Hincks (1880a), Norman (1903b), and Harmer (1926) and reproduced their figures of the type species but did not list further records of it. Hastings (1930) reported both *A. granulifera* and *A. marginella* from various localities in the Panama Canal area.

Subsequent to Hastings (1930) *Antropora* and its type species have been ascribed an almost pan-tropical distribution and the taxonomic identity of both have become blurred. Additional confusion has been promoted by the introduction and usage of two similar genera, *Dacryonella* Canu and Bassler, 1917 and *Membrendoecium* Canu and Bassler, 1917. *Dacryonella* was introduced for the Eocene fossil *D. octonaria* Canu and Bassler, 1917, but Recent *D. typica* Canu and Bassler, 1928a, was later described from the Gulf of Mexico. In the same work Canu and Bassler (1928a) also described a new species, *Antropora pustulata*, which they stated differed from *A. granulifera* in the presence of an extensive gymnocyst, six distal spines, sporadic kenozooids and hyperstomial ovicells, all characters which demonstrate that this species clearly does not belong in *Antropora*. Later Canu and Bassler

(1929) described from the Philippines and assigned to the genus *D. minor* (Hincks, 1880b), *D. ogivalina* sp. nov., *D. trapezoides* sp. nov. and *D. subvespertilio* sp. nov. *Membrendoecium* was introduced for *Amphiblestrum papillatum* Busk, 1884, by Canu and Bassler (1917) who later (Canu and Bassler 1929) assigned to the genus *M. savarti* (MacGillivray, 1890), *M. ovatum* sp. nov., *M. lagunculum* sp. nov. and *M. japonicum* sp. nov. from the Philippines and *M. claustracrassum* from the Galapagos Islands (Canu and Bassler, 1930). Neither genus has won acceptance by subsequent authors although Marcus (1937) described *Membrendoecium leucocypha* sp. nov. from Curaçao. Silén (1941) placed *Membrendoecium* in the synonymy of *Antropora* and Osburn (1950) was unable to distinguish between *Antropora*, *Dacryonella* and *Membrendoecium*.

Cook (1968a) provided a diagnosis of *Antropora* and discussed the constitution of the genus and the work of the previous authors. She rejected *Membranipora nigrans* Hincks, 1882 and *Membranipora marginella* Hincks, 1884, both assigned to *Antropora* by Harmer (1926) and re-examined specimens attributed to both *A. granulifera* and *A. marginella* by Harmer, questioning the determinations of several of them. Cook (1968a) also noted the similarity between *Amphiblestrum papillatum* Busk, 1884, and *Membranipora trifolium* var. *minor* Hincks, 1880b, suggesting that they were congeneric.

The need for a review of the genus *Antropora* became apparent during the course of a current study of reef-associated bryozoans recently collected from Vanuatu, from Fiji and from several localities on the Great Barrier Reef. Specimens of a species attributed to *Antropora granulifera* by Ryland and Hayward (1992) were seen to be quite distinct from those figured by Ristedt and Hillmer (1985) as the same species and from those described by Cook (1968a) and Mawatari and Mawatari (1981). This paper redescribes *Antropora granulifera* (Hincks, 1880a) and stabilises the taxon through the selection of a neotype specimen. Type and original published material of all of the other species redescribed herein have been re-examined. Six species of *Antropora* are described and figured, including *Antropora erectirostra* new species. The new genus *Parantropora*, type species *Parantropora penelope* new species, is distinguished from *Antropora* by the lack of discernible dietellae, the presence of lateral-wall septula and the occurrence of very large spatulate vicarious avicularia. The systematic status of the two genera is discussed in relation to several other speciose and taxonomically difficult calloporoidean families.

All material examined is listed; holding institutions are indicated by the following abbreviations: NHM – Zoology Department, The Natural History Museum, London; USNM – Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington DC.

Systematics

The taxonomic order is based on that adopted by Hayward and Ryland (1995) as advocated by Gordon (1984; 1986; 1989). Generic and specific taxonomic diagnoses are given; the descriptions and measurements are based on the examined specimens. The synonymies for each taxon and lists of examined material are deliberately extensive due to the review nature of the paper.

Class Gymnolaemata Allman, 1856

Order Cheilostomatida Busk, 1852

Suborder Neocheilostomatina d'Hondt, 1985

Superfamily Calloporoidea Norman, 1903a

Genus ***Antropora*** Norman

Antropora Norman, 1903b: 87.

Antropora: Harmer, 1926: 232; Canu and Bassler, 1929: 93; Marcus, 1937: 50; Silén, 1941: 43; Osburn, 1950: 51; Cook, 1968a: 137; Mawatari and Mawatari, 1981: 25; Gordon, 1986: 37; Ryland and Hayward, 1992: 229.

Membrendoecium Canu and Bassler, 1917: 17.

Membrendoecium: Canu and Bassler, 1929: 28; Marcus, 1937: 124.

Dacryonella Canu and Bassler, 1917: 28.

Dacryonella: Canu and Bassler, 1928a: 56; Canu and Bassler, 1929: 130.

Generic diagnosis

Colony encrusting, unilaminar or multilaminar. Autozooidal cryptocyst moderately developed around the opesia, gymnocyst negligible or absent. Spines absent. Small interzooidal avicularia present. Large autozooidal-sized vicarious avicularia may be present. Ovicells endozooidal,

presence generally indicated by a slight cap-like thickening at the distal end of the autozooid. Basal pore-chambers (dietellae) present.

The vicarious avicularia are similar in size to autozooids; rostrum broadly triangular, narrowing distally, its lateral walls raised, projecting medially. Opesia of avicularium continuous, almost circular proximally, surrounded by a narrow granular cryptocyst, the junction with the distal part indicated by small proximally pointing condyles; distal part of opesia extending almost the entire length of the rostrum, a slight oral shelf is apparent distally; mandible wide, slightly pointed distally.

Type species

Membranipora granulifera Hincks, 1880a.

Remarks

Much of the confusion surrounding the identity of the type species, *Membranipora granulifera* Hincks, seems to stem from Harmer's (1926) account, which was clearly based on several different species. Neither Hincks (1880a) nor Norman (1903b) described colony form in *Antropora granulifera* and both considered that it was morphologically variable, but there is no doubt that they described the same species. Canu and Bassler (1929) reproduced Hincks's (1880a) original figure, as well as those of Norman (1903b) and Harmer (1926), adding a magnification to that of Hincks, but there is no indication that they examined any of the material described by these authors. The lack of any acceptable type material of *M. granulifera* certainly contributed to the confusion surrounding its taxonomic identity and selection of a neotype (see below) to stabilise the taxon will finally resolve the problem.

The interzooidal avicularia of *A. granulifera* are the most distinctive feature of the species and the most distinctive of any species of *Antropora*. Both Hincks (1880a) and Norman (1903b) gave unambiguous descriptions, noting that their position at the distal corners of the autozooids, with rostra directed medially and almost touching at their distal tips, was constant in all the specimens they examined. Of recent authors, only Ristedt and Hillmer (1985) have noted this feature and correctly identified their material. Harmer (1926) based his description on a suite of specimens from the 'Siboga' expedition, around the Philippines and Indonesia, and on specimens from Ceylon and Japan in the collections from the Zoology Museum, Cambridge. He noted that 'adventitious' avicularia were directed distally or transversely and although he stated that three of the specimens he examined (NHM 1928.3.6.47., Mindanao; NHM 1928.3.6.48., Kei Islands; NHM 1936.12.30.5., Ceylon) agreed with Hincks's original description of *A. granulifera*, and are clearly the same species, he included other specimens which are not actually attributable to *A. granulifera*. Harmer (1926) described these latter specimens with vicarious avicularia, including those from Japan (NHM 1928.9.13.16,17.) as 'young type' colonies, which in fact are attributable to *A. typica*.

Although Mawatari and Mawatari (1981) describe and figure vicarious avicularia in *Antropora granulifera*, no evidence of these structures can be seen in either the Neotype specimen or other specimens of *A. granulifera sensu stricto*. Despite *A. granulifera* itself not producing vicarious avicularia, several other species of *Antropora* do and the generic diagnosis has been amended to take account of this fact.

Gordon (1986) amended the generic description of *Antropora* to include *Antropora pacifera* sp. nov. from New Zealand. However, this species appears to be a member of the genus *Alderina* and so the generic amendment should not be accepted.

Several Recent species allegedly attributable to *Antropora* Norman have not been covered in this paper, mainly due to the lack of type material available for examination; these are as follows:

Dacryonella levigata Canu and Bassler, 1927: 6, pl. 2, figs 7,8.

Membrendoecium compressum Osburn, 1927: 124, figs 1,2; Osburn, 1940: 358 (as *Canua* (*Membrendoecium*) *compressum*).

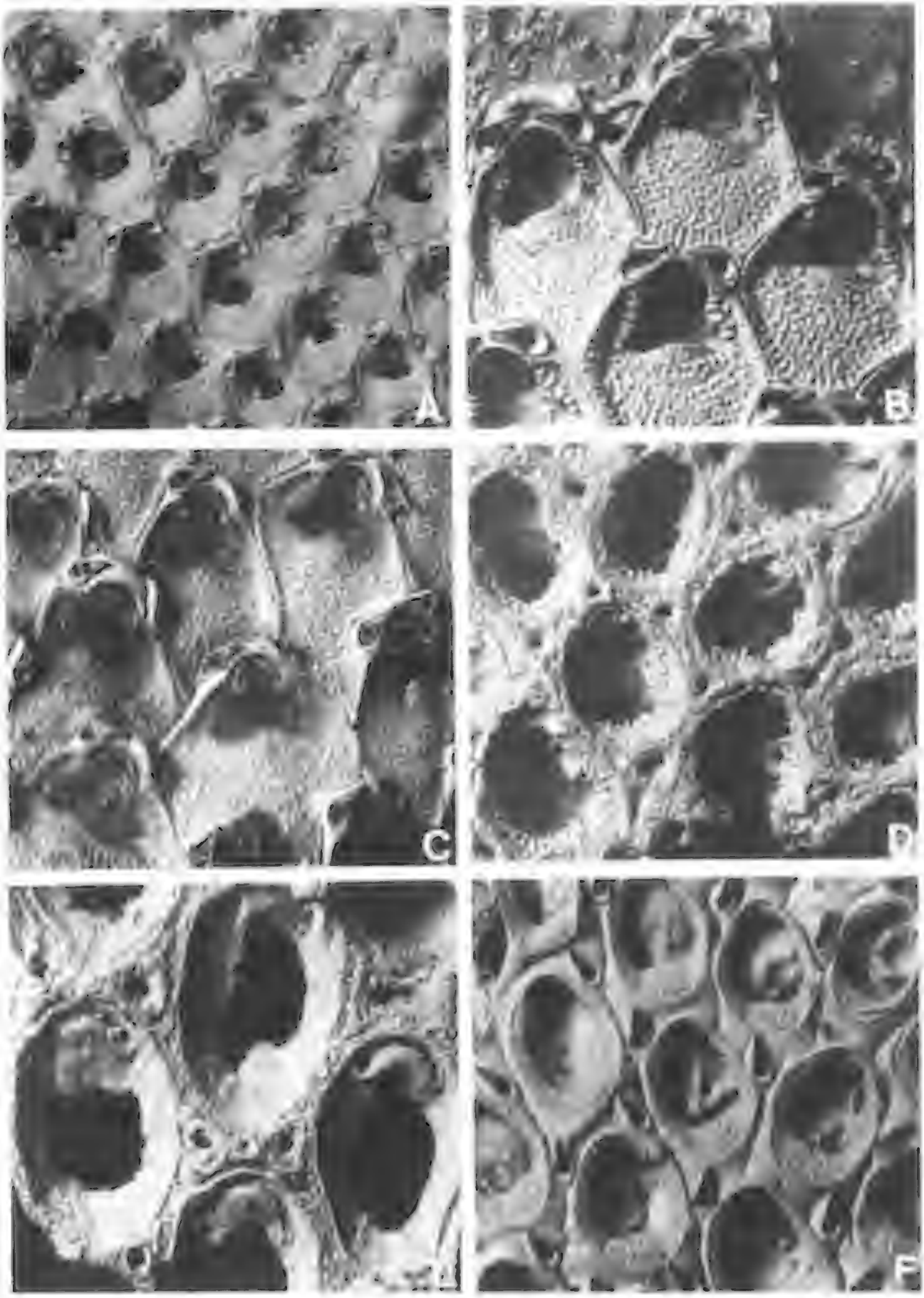
Membrendoecium parvus Canu and Bassler, 1928b: 4, 61, pl. 1, figs 1,2.

Crassimarginatella leucocypha Marcus, 1937: 46, pl. 8, fig. 20 A; pl. 9, figs 20 B,C; Rucker, 1967: 819, fig. 12c (as *Antropora leucocypha*); Mawatari and Mawatari, 1981: 29, fig. 3 (as *Antropora leucocypha*).

Antropora erecta Silén, 1941: 44, figs 56, 57; Mawatari and Mawatari, 1981: 27, fig. 1.

Antropora granulifera (Hincks, 1880a)
(Fig. 1A)

Membranipora granulifera Hincks, 1880a: 72, pl. 9, fig. 4.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Membranipora granulifera: Waters, 1898: 659, 668; Thornely, 1912: 143.

Amphiblestrum granulifera Thornely, 1905: 110.

Antropora granulifera Norman, 1903b: 87, pl. 8, fig. 4.

Antropora granulifera: Harmer, 1926: 232 (in part), pl. 14, figs 11–14; Hastings, 1930: 714; Osburn, 1940: 358; Osburn, 1950: 52, pl. 9; Cook, 1968a: 138, fig. 9; Cook, 1968b: 149; Mawatari and Mawatari, 1981: 28 (in part), fig. 2; Ristedt and Hillmer, 1985: pl. 1, fig. 3; Cuffey, 1987: 506, fig. 168.

not *Antropora granulifera*: Ryland and Hayward, 1992: 229, fig. 2c.

Dacryonella trapezoides Canu and Bassler, 1929: 133, pl. 14, figs 2,3.

Material examined

Neotype, here chosen: NHM 1919.6.25.23., Madeira, Norman Coll.

Other material examined: NHM 1919.6.25.24., Madeira, Norman Coll.; NHM 1879.5.28.6., Madeira, Rev. R. B. Watson; NHM 1879.5.28.11., Madeira, Rev. R. B. Watson; NHM 1911.10.1.628., Madeira, 25–70 feet; NHM 1882.10.18.125–138., Darros Id, Amirante Is, 22 fathoms, HMS Alert; NHM 1903.1.29.10,11., Fuafatu, Funafuti, 60 fathoms; NHM 1928.3.6.47., Siboga Stn 133, Lirung, Talaut Is, S. of Mindanao. 0–36m; NHM 1928.3.6.48., Siboga Stn 257, Kei Is, 0–52m; NHM 1928.9.13.15., Ceylon (Sri Lanka); NHM 1929.4.26.81., Jicaron Islands, St George Coll.; NHM 1936.12.30.5., Ceylon (Sri Lanka), L. R. Thornely; NHM 1970.8.4.23., Calypso Coll., Stn P.7, 6m; NHM 1997.10.6.4., Iririki Island, Vanuatu; USNM 7936., (Cotypes of *D. trapezoides*. 2 pieces) Alb. Sta. 5151, off Sirun Id, Tawi-tawi Is, Philippines. 24 fathoms; NHM 1931.12.30.43,44., (Topotype of *D. trapezoides*.) Alb. Sta. 5151, off Sirun Id, Tawi-tawi Is, Philippines. 24 fathoms. (exc. USNM).

Description

Colony forming flat, unilaminar sheets. Autozooids irregularly polygonal to hexagonal in fairly distinct alternating longitudinal rows, separated by discernible grooves. Frontal surface bordered by a crenulated mural rim, raised particularly to the distal end of the autozooid. Gymnocyst proximal, very reduced or negligible; cryptocyst occupying generally less than one half of total autozooid length, flat or very slightly convex, coarsely beaded. Opesia roughly triangular to slightly trifoliate, constricted at the proximal edge of the operculum opening. Distal to each autozooid a pair of medium-sized triangular, interzooidal avicularia. Rostra raised and acute to frontal plane, directed medially, often touching at the midline, or rarely very slightly disto-medially, particularly in ovicellate zooids; mandibles long and acutely triangular. Ovicell endozooidal, small, indistinct.

Mature dried colonies are chocolate brown in appearance, lighter and more translucent at the growing edge. The opercula are slightly darker than the rest of the frontal membrane. Cook (1968a) describes the opercula of fertile zooids as showing a slight dimorphism, i.e. wider and darker in colour than other autozooids.

FIGURE 1. **A**, *Antropora granulifera* (Hincks, 1880a), Neotype specimen NHM 1919.6.25.23., Madeira. Group of autozooids. x27. **B**, *Antropora subvespertilio* (Canu & Bassler, 1929), NHM 1912.12.22.12., Grapples Bank, Puerto Rico. Group of autozooids at the growing edge of the colony with paired distal avicularia and trifoliate opesia. x72. **C**, *Antropora subvespertilio* (Canu & Bassler, 1929), NHM 1912.12.22.12., Grapples Bank, Puerto Rico. Group of zooids with frontal membrane intact, note the wider operculum in the ovicellate zooids. x45. **D**, *Antropora tincta* (Hastings, 1930), Paratype specimen NHM 1929.4.26.72., Gorgona, Colombia. Group of autozooids, the interzooidal angles filled with either small rounded kenozooids or small interzooidal avicularia. x63. **E**, *Antropora tincta* (Hastings, 1930), Paratype specimen NHM 1929.4.26.72., Gorgona, Colombia. Group of autozooids, showing the size of the interzooidal kenozooids and avicularia and zooidal opercula. x108. **F**, *Antropora typica* (Canu & Bassler, 1928a), NHM 1928.9.13.16., Okinose, off Tokyo, Japan. Group of autozooids showing the position of the teardrop-shaped interzooidal avicularia and the extensive gymnocyst. x63.

Measurements (mm): mean±standard deviation

Specimen	n	Autozooid Length	Autozooid Width	Opesial Length	Opesial Width	Avic. Length
NHM 1919.6.25.23. Neotype.	25	0.56±0.06	0.41±0.03	0.28±0.05	0.23±0.06	0.16±0.05
Cook (1968a)	–	0.40–0.58	0.27–0.40	0.20–0.32	–	0.11–0.15
C and B (1929) (*D. trapezoides*)	–	0.55	0.45	0.20–0.22	0.20–0.25	–
NHM 1997.10.6.4.	25	0.60±0.08	0.52±0.06	0.30±0.02	0.26±0.06	0.14±0.02

Remarks

Antropora granulifera is especially characterised by the presence of two medially directed avicularia, often touching at the midline, at the distal end of every autozooid. *A. granulifera* has been reported from the warm-temperate eastern Atlantic, from the tropical eastern Pacific and from numerous localities in the Indo-West Pacific, but the taxonomic identity of the species has not been adequately reviewed.

Hincks's (1880a) description of this species is very accurate, but seems to have been overlooked by subsequent authors. Harmer's (1926) later account of *A. granulifera* seems to have caused confusion; many of the specimens he described clearly do not belong to this species, as noted by Powell (1967) and Cook (1968a). For the stabilisation of the taxon, and in the absence of the original holotype specimen, there is justification in selecting a neotype specimen, from Madeira, the type locality. No extant specimens are known from the collection of T. H. Hincks, but a Norman Collection specimen from Madeira, NHM 1919.6.25.23., is clearly the same species as that figured by Hincks (1880a) and is accordingly here selected as neotype.

Canu and Bassler (1917) erected a new genus *Dacryonella*, and later (Canu and Bassler 1929) described *D. trapezoides* sp. nov. from the Philippines; examination of type series material of *Dacryonella trapezoides* shows it to be indistinguishable from *Antropora granulifera*. (The USNM cotype specimens are heavily calcified and very abraded, but have very similar proportions to the neotype specimen of *A. granulifera*.)

Cook (1968a) examined *A. granulifera* specimens from the Canary Islands and several stations off West Africa and was confident that this material represented a single species, noting that in all characters other than size it was similar to material from the Indo-Pacific; material from the Indo-Pacific having larger zooids than that from Panama, Madeira and West Africa.

The account of *A. granulifera* by Mawatari and Mawatari (1981) and their fig. 2, leaves a certain doubt as to the true identity of the specimens they were describing. They described the presence of vicarious avicularia, illustrating a mandible, and the interzooidal avicularia are far smaller relative to the size of the autozooid, than in specimens of *A. granulifera* examined here. Two specimens from Japan (NHM 1928.9.13.16,17.) and one from Malaysia (NHM 1928.3.6.49.), in the Natural History Museum, London, formerly referred to *A. granulifera* are here regarded as belonging to *A. typica* (below). Two further specimens, from Aden (NHM 1966.1.2.3.) and Muscat (NHM 1981.2.6.1.) respectively, contain shell debris which shows no evidence of *A. granulifera*, but instead is encrusted by a mixture of *A. tincta* and *A. minor*. The species figured by Ryland and Hayward (1992) is not *A. granulifera*; however, as their specimen has not been available for examination, no specific designation can be given.

Norman (1903b) describes and figures three pairs of dietellae and several, usually four, 'lucid spots' in the basal wall, similar to those seen in *A. typica*.

Distribution

Madeira; Cape Verde Is; Indian Ocean; Ceylon (Sri Lanka); Malaysia; Philippines; Iririki Island, Vanuatu; Hawaii; Jicaron Id, Panama; Secas Is, Panama; Gulf of Panama; Petatlan Bay, Mexico; Puerto Rico; Bermuda.

This species is found in warm temperate and tropical waters globally. The record from Japan must be considered unsubstantiated.

Antropora subvespertilio (Canu and Bassler, 1929)
(Fig. 1B,C)

Dacryonella subvespertilio Canu and Bassler 1929: 134, pl. 14, fig. 1.

Measurements (mm): mean±standard deviation

Specimen	n	Autozooid Length	Autozooid Width	Opesial Length	Opesial Width	Avic. Length
C and B (1929) *D. subvespertilio*	–	0.35	0.40–0.45	0.19	0.11	–
NHM 1912.12.22.2.	30	0.53±0.06	0.43±0.04	0.22±0.02	0.18±0.01	0.15±0.01

Material examined

Holotype: USNM 7937, Alb. Sta. 5179, off Romblon Light, Romblon, Philippines, 37 fathoms.

Other material examined: NHM 1912.12.22.2. (as *Antropora granulifera*), Grapples Bank, SE corner of Puerto Rico, 124–142 fathoms.

Description

Colony unilaminar, encrusting. Autozooids distinct, broad, separated by shallow grooves. Frontal membrane bordered by thin, rounded mural rim. Gymnocyst negligible; cryptocyst, extensive, below mural rim, finely granular, somewhat convex. Opesia trifoliate, less than half frontal area, the proximal border convex with two lateral opesiular indentations, rather deep and rounded, with crenellate edges. Distal to each autozooid, two small, triangular interzooidal avicularia, directed medially, often touching, or slightly disto-medially, particularly in ovicellate zooids; rostrum slightly raised, acutely pointed distally, rounded proximally; two small articulatory condyles; mandibles acutely triangular, slightly recurved. Ovicells endozooidal, small, smooth, cap-like. Operculum of ovicellate zooids wider than autozooids, closing the ovicell.

Remarks

Antropora subvespertilio, originally described from the Philippines, is easily identified by the presence of the two medially directed avicularia distal to each autozooid and the possession of lateral, opesiular indentations of the cryptocyst, giving the characteristic trifoliate opesia.

Specimen NHM 1912.12.22.2., from Puerto Rico, originally assigned to *A. granulifera*, is undoubtedly the above species when compared with the type specimen from the Philippines. This mistaken attribution is understandable as in the dried specimen of *A. subvespertilio* the shape of the opesia is hidden by the opaque frontal membrane.

Distribution

Philippines and Puerto Rico.

Antropora tincta (Hastings, 1930)
(Fig. 1D,E)

Crassimarginatella tincta Hastings, 1930: 708, pl. 5, figs 16–19; pl. 17, fig. 120.

Antropora tincta Osburn, 1950: p. 54, pl. 4, fig. 7; pl. 29, figs 7,8.

Antropora tincta: Cook, 1968a: 140, fig. 11; Cook, 1968b: 150; Mawatari and Mawatari, 1981: 34, fig. 4; Hayward, 1988: 276, fig. 2f.

Material examined

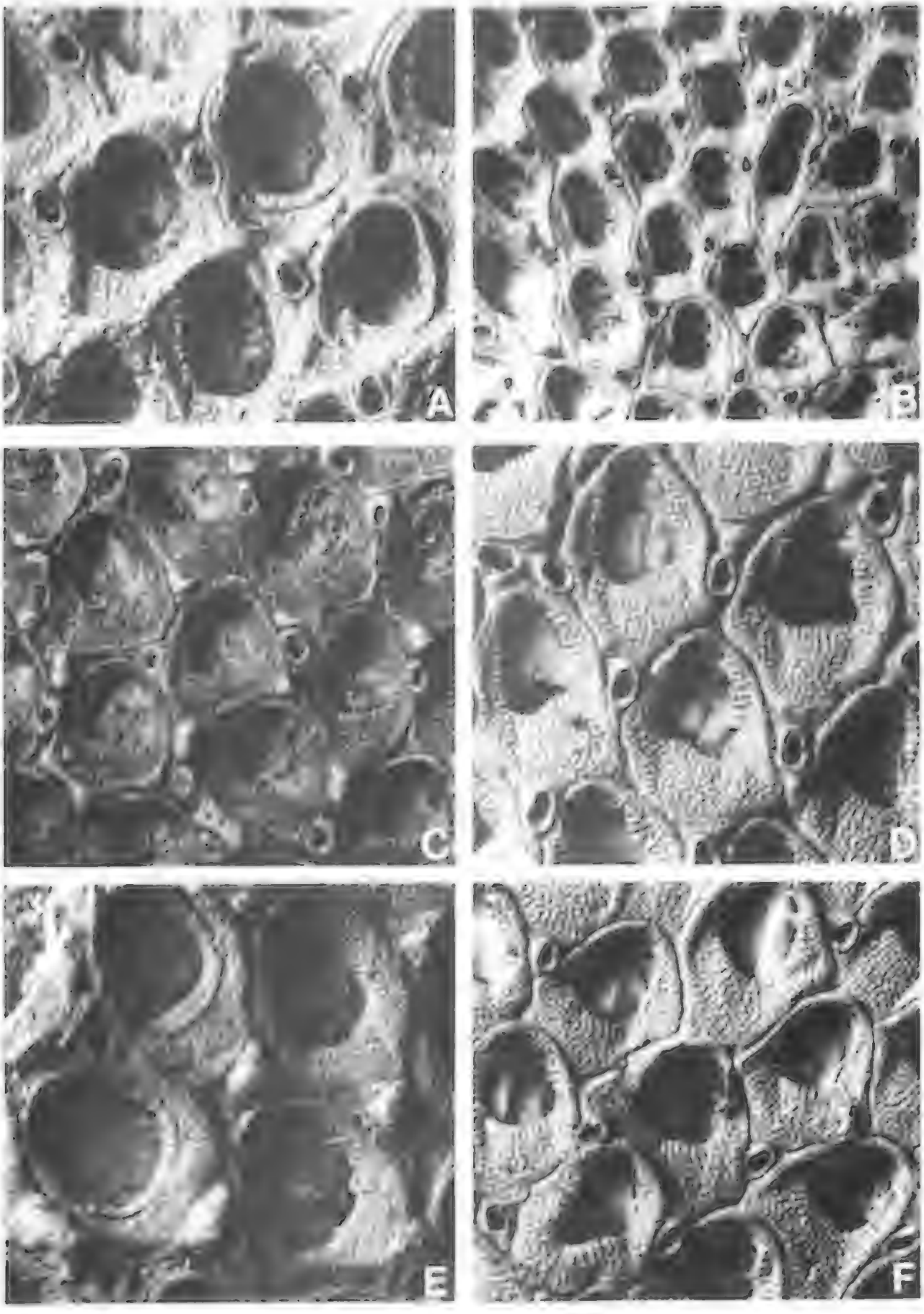
Paratype: NHM 1929.4.26.72. (part), Gorgona 3, St. George Coll. (Figured by Hastings 1930: fig. 120.)

(Holotype specimen NHM 1929.4.26.28. Galapagos Stn 9A, cited by Hastings (1930), cannot be located.)

Other material examined: NHM 1930.9.18.1., Puntas Arenas, Central America; NHM 1966.3.2.2., East of Angel de Guardia Id, Gulf of California, 40 fathoms; NHM 1966.9.2.6. (in part) (as *Antropora* sp.), Massawa Harbour, Red Sea coast of Ethiopia, N. A. Powell; NHM 1970.2.8.7., Teshie Rocks, E of Accra, 1–2m. Coll. W. Pople; NHM 1970.8.10.19., SE of Tema, Ghana. Coll. W. Pople; NHM 1975.9.10.7–9., South Seymour Id, Galapagos Islands; NHM 1992.1.23.17., Tamarin, Mauritius; NHM 1961.11.2.53. (as *Crassimarginatella leucocypha*), Campeche Bank, Gulf of Mexico, 24°4'N, 91°51'W, 26 fathoms. Coll. A. Cheetham.

Description

Colony encrusting, multilaminar. Autozooids distinct, irregularly oval, with thin mural rim. Gymnocyst vestigial; cryptocyst, narrow, granular, concave, thicker proximally, inner margin sometimes denticulate. Opesia almost filling entire frontal area. Interzooidal angles with either small rounded kenozooids or small interzooidal avicularia; mandible semi-circular to triangular with a rounded tip, no crossbar, but condyles are present. Endozooidal ovicells, forming rather shallow caps on autozooids, are described by Mawatari and Mawatari (1981). Colour, when alive or dried, ranging from white to light pink to pinkish-brown with increasing age and calcification.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Measurements (mm): mean±standard deviation

Specimen	n	Autozooid Length	Autozooid Width	Opesial Length	Opesial Width	Avic. Length
NHM 1929.4.26.72. Paratype.	30	0.37±0.07	0.28±0.03	0.28±0.03	0.17±0.02	–
Cook (1968a)	–	0.35–0.52	0.29–0.36	0.19–0.34	–	0.06–0.13
M and M (1981)	–	0.3–0.5	0.2–0.4	0.2–0.4	0.1–0.2	–

Remarks

The most characteristic features of this species are the presence of kenozooids, its often multilaminar nature and its pinkish coloration even when dried. Osburn (1950) noted that colonies may develop erect irregular branches (to 50mm high) particularly when in association with gastropods shells inhabited by pagurid crabs. The dry sectioned specimen (NHM 1966.3.2.2.) from the Gulf of California shows well the multilaminar form of *A. tincta*, as well as its pinkish coloration.

Marcus (1937) described *Crassimarginatella leucocypha* sp. nov. from Brazil, distinguishing it from *A. tincta* by the frequency of kenozooids, the size of the interzooidal avicularia and the shape of their mandibles. Hastings (1930) remarked that some colonies of *A. tincta* have no avicularia whilst in others they are very frequent, a feature noted in *Antropora leucocypha* by Winston (1982). The distinction between the two species has been maintained subsequently, although Cook (1968a) and Winston (1982) both noted the similarity between *A. leucocypha* and *A. tincta*, but there has been no recent redescription of Marcus' species and his type material has not been available for study. Winston's (1982) figures 36 and 37, appear to show two different species though she attributes them to smaller (younger ?) and larger colonies, respectively. Specimen NHM 1961.11.2.53. from the Gulf of Mexico, was originally attributed to *Crassimarginatella leucocypha*, but is undoubtedly *A. tincta*. (NHM 1986.8.14.9. as *Antropora leucocypha*, from Fort Pierce, Florida, is a specimen of *Antropora minor*.) *Crassimarginatella leucocypha* Marcus, 1937, may perhaps prove to be a junior synonym of *A. tincta* (or *A. minor*), but in the absence of accessible holotype material this question cannot be satisfactorily addressed. Rucker (1967) figured as *Antropora leucocypha* a species which looks like neither of the two London specimens mentioned above. Mawatari and Mawatari (1981) figured specimens attributed to *A. leucocypha* and *A. tincta* from Japan which appear to be indistinguishable both in shape and size, although they differentiated between the two species on the basis of the form, size and occurrence of avicularia. In their description of *A. leucocypha*, Mawatari and Mawatari (1981) noted vicarious avicularia as large as the autozooids; these were illustrated in their figure 3, but appear to be regenerated autozooids, showing two cryptocystal rims, rather than vicarious avicularia as described.

A. tincta has a morphology not unlike that of species of the genus *Akatopora* Davis, 1934, as discussed by Gordon (1986); future investigations of *Akatopora* species may remove *A. tincta* from the genus *Antropora* Norman.

Distribution

Galapagos Islands; Point Conception, California; Gulf of California; Peru; Mazatlan, Mexico; Jicaron Islands, Panama; Gorgona Islands, Colombia; Gulf of Mexico; Balboa, Brazil; Ghana, West Africa; Mauritius; Japan.

This species has been recorded from tropical and subtropical regions of the E. Pacific, W.

FIGURE 2. *Antropora minor* (Hincks, 1880b). **A**, Holotype specimen NHM 1899.5.1.654., Bahia, Brazil. Group of zooids, two ovicellate zooids to the left of frame. x108. **B**, NHM 1885.12.24.13., (Holotype specimen of *A. marginella* Hincks, 1884), Mergui Archipelago. Group of zooids (including ovicellate zooids) showing the coarsely granular cryptocyst and lack of gymnocyst. x54. **C**, NHM 1888.4.16.9., Fernando Noronha, Brazil. Group of autozooids showing the raised avicularia and kenozooidal papillae. x72. **D**, NHM 1887.12.9.327. (Type specimen of *A. papillatum* Busk, 1884), 'Challenger' Stn 208, the Philippines. Group of autozooids showing the granular cryptocyst, minimal gymnocyst and raised avicularia. x90. **E**, NHM 1931.12.30.17. (as *Membrendoecium ovatum* Canu & Bassler, 1929), off Sirun Island, Tawi-tawi Islands, Philippines. Group of autozooids showing kenozooidal papillae and evidence of regenerative growth. x72. **F**, NHM 1997.10.6.2., Suva Barrier Reef, Fiji. Group of autozooids showing the positioning of the small interzooidal avicularia, and shape and size of a large vicarious avicularium (centre). x63.

Atlantic, W. Africa and Japan but has not been reported from the SW Pacific.

The following species form a distinct group within the genus *Antropora* Norman, 1903b due to the presence of large vicarious avicularia as well as small interzooidal avicularia common to all members of the genus. The vicarious avicularia are extremely similar in form in all these species, however, their occurrence, and the regularity and form of the small interzooidal avicularia differ greatly.

Antropora minor (Hincks, 1880b)
(Fig. 2A–F)

Membranipora trifolium var. *minor* Hincks, 1880b: 87, pl. 11, fig. 6.

Membranipora trifolium var. *minor*: Hincks, 1885: 147, pl. 8, fig. 7; Robertson, 1921: 47; Waters, 1906: 14.

Dacryonella minor Canu and Bassler, 1929: 131, pl. 13, figs 9–12.

Membrendoecium minus Marcus, 1937: 50, pl. 9, fig. 22 A,B.

Antropora minus Cook, 1968a: 139, fig. 10; Mawatari and Mawatari, 1981: 34.

Amphiblestrum papillatum Busk, 1884: 66, pl. 3, fig. 1.

Membranipora papillata Waters, 1898: 668, 682.

Antropora papillatum Thornely, 1905: 110.

Membrendoecium ovatum Canu and Bassler, 1929: 95, pl. 6, figs 3–5.

Antropora ovata Cuffey and Cox, 1987: 86, fig. 2H.

Dacryonella ogivalina Canu and Bassler, 1929: 132, pl. 13, fig. 8.

Antropora ogivalina Scholz, 1991: 280, fig. 4.

Membrendoecium claustracrassum Canu and Bassler, 1930: 7, pl. 1, figs 3–7.

Antropora claustracrassa Osburn, 1950: 50, pl. 4, fig. 6.

Antropora claustracrassa: Cuffey and Cox, 1987: 86.

Membranipora marginella Hincks, 1884: 358, pl. 13, fig. 1; Hincks, 1893: 204; Waters, 1898: 658, 669.

not *Amphiblestrum marginella* Thornely, 1905: 110.

Antropora marginella Harmer, 1926 (in part): 234; Hastings, 1930: 714; Powell, 1967: 164, pl. 1, fig. 5.

Material examined

Holotype: NHM 1899.5.1.654., Bahia, Brazil. Hincks Coll.

Other material examined: NHM 1888.4.16.9., Fernando Noronha, Brazil; NHM 1931.12.30.41., Alb. Sta. 5151, off Sirun Island, Tawi-tawi Islands, Philippines. 24 fathoms. (exc. USNM); NHM 1992.1.23.17., Tamarin, Mauritius; NHM 1975.18.70. (as *Antropora* sp.), Tungku Beach, Dent Peninsula, NE Sabah; NHM 1975.18.71,72. (as *Antropora* sp.), East coast of Labuan Id, Sabah; NHM 1966.9.2.6. (in part) (as *Antropora* sp.), Massawa Harbour, Red Sea coast of Ethiopia, N. A. Powell; NHM 1887.12.9.327. (2 slides.) (Type of *Amphiblestrum papillatum*), 'Challenger' Stn 208, near the Philippines. 11°37'N., 123°31'E. 18 fathoms, blue mud; USNM 7935 (Type of *Dacryonella ogivalina*), Alb. Sta. 5147, off Sulade Id, Sulu Arch., Philippines. 21 fathoms; NHM 1931.12.30.42. (as *Dacryonella ogivalina*), Alb. Sta. D5217, Anima Sola Id, Ragay G., off N. Burias, Philippines. 13°20'N., 123°14'15"E. 105 fathoms. (exc. USNM); USNM 8472 (Cotype of *Membrendoecium claustracrassum*, 2 pieces), Alb. Sta. D2813. Galapagos Is 40 fathoms; NHM 1933.12.10.10. (as *Membrendoecium claustracrassum*), Alb. Sta. D2813. Galapagos Is 40 fathoms. (exc. USNM); USNM 7867 (Cotype of *Membrendoecium ovatum*, 2 pieces), Alb. Sta. 5137, Julo, Philippines. 20 fathoms; USNM 7868 (Cotype of *Membrendoecium ovatum*, 2 pieces), Alb. Sta. 5179, off Romblon Light, Romblon, Philippines. 37 fathoms; NHM 1931.12.30.16. (as *Membrendoecium ovatum*), Alb. Sta. 5179, off Romblon Light, Romblon, Philippines. 37 fathoms. (exc. USNM); NHM 1931.12.30.17. (as *Membrendoecium ovatum*), Alb. Sta. 5151, off Sirun Island, Tawi-tawi Islands, Philippines. 24 fathoms. (exc. USNM); NHM 1931.12.30.41. (as *Dacryonella minor*), Alb. Sta. 5151, off Sirun Island, Tawi-tawi Islands, Philippines. 24 fathoms. (exc. USNM); NHM 1885.12.29.13. (Syntype of *Antropora marginella*), Mergui Archipelago (off Thailand), Burma (Myanmar), India. Dr. Anderson Coll.; NHM 1899.5.1.602. (Syntype of *Antropora marginella*), Mergui Archipelago (off Thailand), Burma (Myanmar), India. Hincks Coll.; NHM 1997.10.6.2., Suva Barrier Reef, Fiji; NHM 1997.10.6.19., Suva Barrier Reef, Fiji. Reef Crest; NHM

1997.10.6.25., Tailevu Point, Viti Levu, Fiji; NHM 1997.10.6.26., Suva Barrier Reef, Fiji.

Description

Colony encrusting, multilaminar. Autozooids oval, bordered by a distinct, thin mural rim, separated by deep grooves, often wide. Gymnocyst generally minimal; cryptocyst coarsely granular, concave, deeper proximally than laterally, sloping basally. Opesia large, broadly oval or sub-triangular, narrowing distally, occupying over half of the frontal area. Single small interzooidal avicularia, elongate, rounded, mostly distally directed; mandible rounded or more acute, triangular, no crossbar; a cryptocystal rim around avicularium opesia; avicularium raised on small cystid (papillary eminences) seated in the angular interzooidal spaces. Small kenozooidal papillae are also often found at the proximal ends of autozooids in the interzooidal angles either in place of or in conjunction with the avicularia. Ovicells endozooidal, vestigial, indistinct, cap-like. The large autozooid-sized vicarious avicularia described above are often present, although they may be absent from large areas of some colonies; rostrum broadly triangular, its lateral walls raised.

Remarks

Antropora minor is characterised by the lack of a gymnocyst, the interzooidal avicularia on raised cystids, papillae-like kenozooids found proximally to the autozooids, and the presence of large vicarious avicularia. However, the frequency and spacing of both the kenozooids and the vicarious avicularia vary greatly between colonies.

The presence of small kenozooids in *A. minor* is unusual in *Antropora* and is seen otherwise only in *A. tincta*. These two species are multilaminar, and kenozooids may reflect discontinuities in colony form associated with multilayered growth. Canu and Bassler (1929) in their discussion of *Membrendoecium ovatum*, state that while autozooidal regeneration is common in *Antropora* (*Membrendoecium*) species, it is extraordinarily frequent in this species (e.g. NHM 1931.12.30.17.); the presence of kenozooids may perhaps indicate or facilitate regenerative growth.

The synonymy of *Membranipora trifolium* var. *minor* Hincks and *Amphiblestrum papillatum* Busk was first proposed by Waters (1898; 1909) but rejected by Marcus (1937). Cook (1968a) commented on the similarity of *A. minor* with *A papillatum*, but distinguished the two species on size, autozooids of *A. papillatum* being larger than those of *A. minor*.

Canu and Bassler (1929) remarked on the great resemblance of their new species, *Dacryonella ogivalina* to *Antropora minor* (Hincks, 1880b) but concluded that they were separate species due to the greater autozooidal dimensions of *D.*

Measurements (mm): mean±standard deviation

Specimen	n	Autozooid Length	Autozooid Width	Opesial Length	Opesial Width	Avic. Length
1899.5.1.654. Holotype.	30	0.32±0.03	0.24±0.02	0.19±0.01	0.14±0.01	0.08±0.01
C and B (1929) (*M. ovatum*)	–	0.50	0.35–0.40	0.30	0.22	–
C and B (1929) (*D. ogivalina*)	–	0.48–0.50	0.30	0.20–0.22	0.18–0.20	–
C and B (1929) (*D. minor*)	–	0.35–0.45	0.25–0.30	0.15–0.25	0.11–0.20	–
C and B (1930) (*M. claustracrassum*)	–	0.4–0.5	0.3	0.26–0.30	0.16–0.18	–
Cook (1968a) (*A. papillatum*)	–	0.30–0.42	0.15–0.23	0.12–0.15	–	0.05–0.09
Cook (1968a) (*A. minus*)	–	0.25–0.33	0.17–0.20	0.15–0.23	–	0.04–0.07
NHM 1899.5.1.602. (*A. marginella*)	30	0.32±0.04	0.22±0.02	0.19±0.03	0.13±0.02	0.09±0.01
NHM 1997.10.6.2.	20	0.35±0.04	0.28±0.03	0.19±0.03	0.15±0.02	0.08±0.01

ogivalina. A variation in autozooidal size in *D. ogivalina* was observed by Canu and Bassler (1929) leading them to present two sets of measurements, for small and large autozooids, from a single colony.

A comparison of specimens of *A. papillatum* from the Philippines, *D. ogivalina* from the Philippines, *M. ovatum* and *A. minor* from Brazil shows that despite the smaller average size of the autozooids of *A. minor* and the Philippine colonies of *A. papillatum* and *D. ogivalina* they are otherwise morphologically indistinguishable.

Canu and Bassler (1920) cite *Amphiblestrum papillatum* Busk, 1884 as the 'genotype' species of the genus *Membrendoecium* Canu and Bassler, 1917. With the synonymy of *A. minor* and *A. papillatum*, *Membrendoecium* Canu and Bassler, 1917 becomes a junior subjective synonym of *Antropora* Norman, 1903b.

Canu and Bassler (1930) noted that their *Membrendoecium claustracrassum* sp. nov. from the Galapagos Islands, could perhaps be the same species as *A. papillatum*, and comparison of cotype (USNM 8472) and topotype (NHM 1933.12.10.10.) material of *M. claustracrassum* with the specimens listed above, shows this indeed to be the case. The cotype material of *M. claustracrassum* also possesses several autozooid-sized vicarious avicularia which have not been noted previously.

Osburn (1950) noted that the ancestrula of *A. claustracrassa* was half the size of later zooids while autozooids originating secondary laminae were noticeably larger than other zooids; he also noted that occasionally the avicularia are replaced by small 'nodules' (kenozooids).

The presence of vicarious avicularia in *M. claustracrassum* suggests the synonymy of *A. minor* and *A. marginella*. Although neither the type specimen of *A. minor* (NHM 1899.5.1.654.) nor that of *A. marginella* (NHM 1899.5.1.602.) show vicarious avicularia, in all other respects the two specimens are identical and indistinguishable from *M. claustracrassum* which does possess vicarious avicularia.

Hincks (1884) did, however, describe vicarious avicularia in *Membranipora marginella* sp. nov., noting 'cells with a very large oral operculum of a dark horn-colour', concluding that they were either avicularia or a reproductive structure. Hincks (1893) later realised that they were in fact vicarious avicularia as noted by Waters (1898).

Thornely (1905) also noted the presence of vicarious avicularia, in her description of *Amphiblestrum marginella* from Ceylon; she described the small interzooidal avicularia as more pointed than described by Hincks and 'directed upwards instead of downwards'; examination of her material (NHM 1936.12.30.6.) shows that she was describing a colony of the new species, *Antropora erectirostra*, which also has vicarious avicularia.

Harmer (1926) in his description of *A. marginella* was unsure about the presence of 'rosette-plates' (septula) but doubted that 'pore-chambers' (dietellae) were present. It is unsure to which specimens Harmer (1926) referred in his descriptions as material he examined has now been assigned to not only *A. minor*, but also *Parantropora laguncula* and *Retevirgula aggregata*.

A specimen from Fort Pierce, Florida (NHM 1986.8.14.9.), originally labelled *Antropora leucocypha* (Marcus, 1937), is undoubtedly *A. minor*. The taxonomic identity of Marcus' species, and any synonymy, is difficult without reference to the type material, in the absence of which no conclusion may be drawn.

Osburn (1927) in his original description of the multilaminar *Membrendoecium compressum* noted its similarity to *A. papillatum*, though it differed in its closely packed zooids and thicker colony. Marcus (1937) considered that *M. compressum* might be a synonym of *A. minor*. Osburn's type material has not been available for study.

The species described by Canu and Bassler (1929) as *Amphiblestrum papillatum* Busk (NHM 1931.12.30.25.), mentioned by Cook (1968a), differs from Busk's species in a number of ways: it has six to eight spines around the distal end of each autozooid, the opesial rim is greatly raised, it bears no avicularia, the gymnocyst is elongated, and finally it bears large globular hyperstomial ovicells. These features put this specimen within one of the genera akin to the genus *Crassimarginatella* Canu, 1900, rather than genus *Antropora* Norman.

Distribution

Bahia, and Fernando Noronha, Brazil; Guyamas, Mexico; La Libertad, Ecuador; Colombia; Panama Canal; Galapagos Islands; Tahiti; Enewetak Atoll; Chatham Islands; Fiji; Japan; Philippines; Singapore; Mergui Archipelago (off Thailand); Ceylon (Sri Lanka); Red Sea.

This species appears to have a circum-tropical distribution.

Antropora typica (Canu and Bassler, 1928a) (Fig. 1F; Fig. 3A)

Antropora granulifera Harmer, 1926: 232 (in part), pl. 14, figs 12–14.

Antropora granulifera: Mawatari and Mawatari, 1981: 28 (in part), fig. 2.

Dacryonella typica Canu and Bassler, 1928a: 87, pl. 5, figs 4–8; pl. 32, figs 11,12.

Dacryonella typica: Canu and Bassler, 1928b: 8, 65, pl. 1, fig. 10.

Antropora typica Rucker, 1967: 817, fig. 12b.

Antropora typica: Winston, 1986: 5, figs 1,2.

Membrendoecium strictorostris Canu and Bassler, 1928a: 23, pl. 2, fig. 7.

Canua (*Membrendoecium*) *strictorostris* Osburn, 1940: 358.

Crassimarginatella cookae Hayward, 1988: 277, figs 2c–e.

Material examined

Holotype Series: USNM 7484 (2 pieces), Alb. Sta. 2319, North of Cuba. 23°10'37"N, 82°20'6"W, 143 fathoms; USNM 7485 (2 pieces), Alb. Sta. 2320, North of Cuba.

Other material examined: NHM 1932.3.7.51., North of Cuba. (exc. USNM); NHM 1899.7.1.988,989. (as *Antropora sp.*), John Adam's Bank, Brazil; NHM 1928.3.6.49. (as *Antropora granulifera*), Siboga Stn 310. E. Sumbawa, Malaysia; NHM 1928.9.13.16. (as *Antropora granulifera*), Okinose off Tokyo, Japan; NHM 1928.9.13.17. (as *Antropora granulifera*), Shikoku, Japan; USNM 7552 (Holotype of *Membrendoecium strictorostris*), Alb. Sta. 2319, North of Cuba. 23°10'37"N, 82°20'6"W, 143 fathoms; NHM 1934.10.8.9., Mauritius.

Description

Colony unilaminar, encrusting. Autozooids distinct, oval, separated by indistinct grooves, may form longitudinal rows. Thin mural rim. Opesia two-thirds of total autozooid length, oval, with a narrow border of granular cryptocyst, broadest proximally, where it grades into smooth obvious gymnocystal calcification. A pair of small, distally directed, interzooidal avicularia at the distal end of most autozooids; mandible acutely triangular; rostrum narrow, acute, tear drop-shaped, distally directed, with a distinct granular cryptocyst proximally and elongate oval opesia; lacking a crossbar. Ovicell endozooidal, small, partly immersed beneath succeeding autozooid, but distinct in frontal view; hemispherical, imperforate, smooth, cap-like. Operculum of ovicellate zooids wider than autozooids, and closing the ovicell. Large vicarious avicularia occur sporadically, each with a semi-elliptical mandible equivalent to one-third total length, supported by a slightly raised, arched rostrum. One or, generally, two very thin areas of basal calcification, distally (see *A. granulifera* above). Canu and Bassler (1928a) describe living colonies as light rose in colour.

Remarks

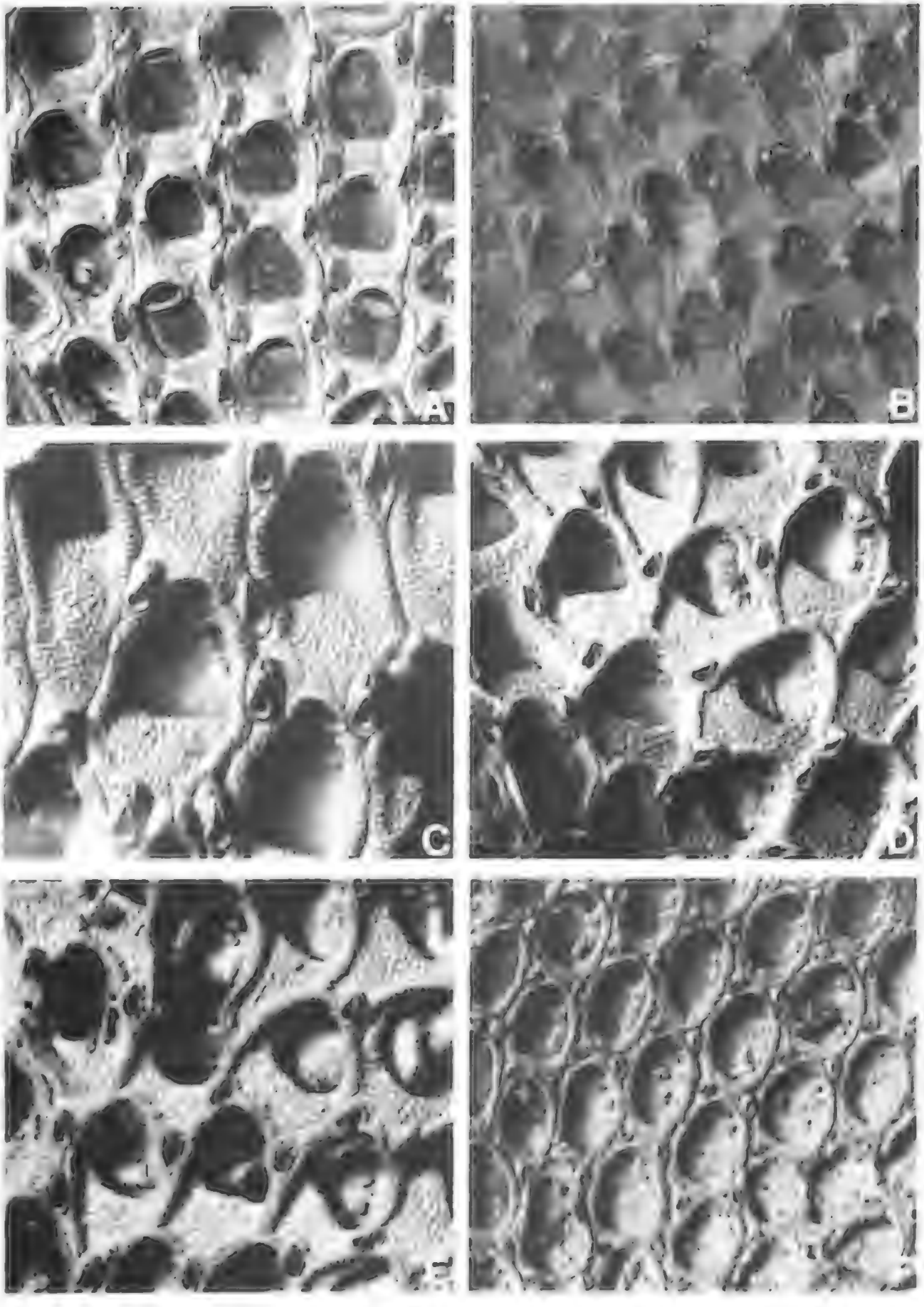
This species is characterised by the presence of frequent tear drop-shaped interzooidal avicularia, with acute distally pointing mandibles; the gymnocyst is obvious and the large vicarious avicularia are also often quite frequent.

The size of the autozooids varies greatly within colonies and between geographic localities, as noted by Canu and Bassler (1928a) in material from off Cuba, and has thus been mistakenly identified subsequently by several authors.

Harmer (1926) described material of *Antropora granulifera* from Malaysia (NHM 1928.3.6.49.) and Japan (NHM 1928.9.13.16, 17.) which are clearly referable to this species. Following Cook (1968a), Hayward (1988) recognised another Natural History Museum specimen (NHM 1934.10.8.9.), from Mauritius, assigned to *A.*

Measurements (mm): mean±standard deviation

Specimen	n	Autozooid Length	Autozooid Width	Opesial Length	Opesial Width	Avic. Length
USNM 7484 Holotype.	30	0.46±0.06	0.29±0.05	0.26±0.02	0.18±0.03	0.12±0.01
C and B (1928a)	–	0.45	0.30	0.20	0.15	0.10
C and B (1928b)	–	0.40–0.45	0.25–0.30	0.20–0.23	0.17–0.20	–
Hayward (1988) (*C. cookae*)	20	0.51±0.06	0.31±0.04	–	–	–


A
B
C
D

granulifera, as a different species, describing it as the new species, *Crassimarginatella cookae*. Comparison of the specimens cited by Harmer (1926) and Hayward (1988) with Canu and Bassler's (1928a) type series of *Dacryonella typica* (USNM 7484, 7485) shows them to be conspecific.

Canu and Bassler (1928a) described *Membrendoecium strictorostris* from Alb. Stn 2319, north of Cuba, the type locality of *Dacryonella typica*; comparison of the two sets of type material shows them to be the same species, though neither types show the vicarious avicularia seen in other material belonging to this species.

Canu and Bassler (1927) described *Dacryonella levigata* sp. nov. from Hawaii; the general description and appearance seem very similar to *C. typica*, although their measurements of *D. levigata* are smaller than those of the specimens listed above. In the absence of material of *D. levigata*, no firm conclusion as to its relation with *C. typica* can be voiced. Rucker's (1967) figured specimen is clearly recognisable as this species, as are those specimens figured by Winston (1986).

The fossil type series specimens from the Pliocene of Panama (USNM 70838), are not included in the above review as they differ from the Recent material in several respects, i.e. a more extensive cryptocyst, less frequent occurrence of the small interzooidal avicularia and absence of large vicarious avicularia, and cannot be synonymised with confidence.

Distribution

Cuba; Jamaica; John Adam's Bank off Brazil; Mauritius; Sumbawa, Malaysia; Japan.

Antropora erectirostra Tilbrook, new species (Fig. 3B,C)

Amphiblestrum marginella Thornely, 1905: 110.

Material examined

Holotype: NHM 1899.7.1.1086., Ceylon (Sri Lanka). Busk Coll.

Paratypes: NHM 1899.7.1.1084, 1085, 1087., Ceylon (Sri Lanka). Busk Coll.

Other material examined: NHM 1936.12.30.6. (as *Antropora marginella*), Gulf of Manaar, Ceylon. L. R. Thornely.

Etymology

erectus, L. upright; *rostrum*, L. beak. Named after its highly raised small interzooidal avicularia.

Description

Colony, encrusting, unilaminar. Autozooids about twice as long as wide, separated by deep grooves. Gymnocyst is minimal; cryptocyst granular, very deep proximally, sloping slightly basally, distal edge flat to somewhat convex. Opesia rounded, triangular, occupying half frontal area. On many autozooids one or two interzooidal avicularia are placed disto-laterally; mandible

Measurements (mm): mean±standard deviation

Specimen	n	Autozooid Length	Autozooid Width	Opesial Length	Opesial Width	Avic. Length
NHM 1899.7.1.1086. Holotype.	25	0.50±0.04	0.24±0.03	0.25±0.03	0.16±0.09	0.13±0.02

FIGURE 3. **A**, *Antropora typica* (Canu & Bassler, 1928a), NHM 1928.3.6.49., E Sumbawa, Malaysia. Group of zooids, showing several ovicellate zooids (note the wider opercula) and a large vicarious avicularium slightly left of centre. x36. **B**, *Antropora erectirostra* new species, Holotype specimen NHM 1988.7.1.1086., Ceylon (Sri Lanka). Group of autozooids showing the zooidal arrangement and highly raised interzooidal avicularia. x36. **C**, *Antropora erectirostra* new species, Paratype specimen NHM 1988.7.1.1085., Ceylon (Sri Lanka). Group of autozooids showing the granular cryptocyst and minimal gymnocyst; several of the interzooidal avicularia appear to have regenerated. x90. **D**, *Parantropora penelope*, new genus, new species, Holotype specimen NHM 1997.10.6.1., Magnetic Island, Townsville, Queensland, Australia. Group of autozooids. x45. **E**, *Parantropora penelope*, new genus, new species, Holotype specimen NHM 1997.10.6.1., Magnetic Island, Townsville, Queensland, Australia. Group of zooids including a very large vicarious avicularium at the centre top. x54. **F**, *Parantropora laguncula* (Canu & Bassler, 1929), NHM 1931.12.30.14., off Sirun Island, Tawi-tawi Islands, Philippines. Group of zooids including a very large vicarious avicularium. x36.

acutely triangular, arched, distally directed; rostrum distally pointed, raised. Rare vicarious avicularia, as large as autozooids; rostrum broadly triangular, narrowing distally, its lateral walls raised. Ovicells small, endozooidal. Kenozooids frequent in disturbed areas of a colony.

Remarks

The presence of the raised, distally directed interzooidal avicularia make this species easily distinguishable from others of the genus.

The autozooids form approximately parallel rows, becoming rather longer and slimmer with increasing colony size. The interzooidal avicularia are most acute and the rostrum most raised nearer the growing edge, the mandibles are more arched.

Thornely's specimen from Ceylon (NHM 1936.12.30.6. as *A. marginella*) is undoubtedly *A. erectirostra* (see *A. marginella* discussion above).

Silén's (1941) *Antropora erecta* sp. nov. is very similar to *Antropora erectirostra*, though he describes the colony as erect and branching, with the 'structure of a cylinder surrounding a cavity'; he makes no mention of the large vicarious avicularia, seen only rarely in *A. erectirostra*.

Distribution

This species is known only from Sri Lanka (Ceylon).

Parantropora Tilbrook, gen. nov.

Generic diagnosis

Colony encrusting. Autozooidal cryptocyst moderately developed around the opesia, gymnocyst negligible or absent. Spines absent. Small interzooidal avicularia present. Large spatulate vicarious avicularia present, much larger than autozooids. Ovicells endozooidal. Mural septula present.

Type species

Parantropora penelope Tilbrook, new species.

Etymology

The genus is named for its resemblance to *Antropora*.

Remarks

This genus is very similar to *Antropora*. However, the lack of dietellae, the presence of lateral-wall (mural) septula and the occurrence of very large spatulate vicarious avicularia, make species of this genus quite distinct. The presence of 'special zooecia' was first noted by Canu and Bassler (1929) in *Membrendoecium lagunculum* sp. nov., though they failed to recognise them as avicularia. Whereas, the vicarious avicularia in species of *Antropora* are autozooid size and shape and so easily overlooked in a colony (Figs 2F and 3A), those of *Parantropora* are considerably larger than the surrounding autozooids; in *P. penelope* (Fig. 3E) they are one-third as long again, and in *P. laguncula* (Fig. 4A) almost half as long again, as the average autozooid.

Species of *Parantropora* generally have a more delicate structure to their side walls than do species of *Antropora*.

Parantropora penelope Tilbrook, new species (Fig. 3D,E)

?*Antropora granulifera* Ryland and Hayward, 1992: 229, fig. 2c.

Etymology

Named after my mother, Leah Penelope Tilbrook.

Material examined

Holotype: NHM 1997.10.6.1., Magnetic Island, Townsville, Queensland. Coll. J. S. Ryland.

Other material examined: NHM 1997.10.6.17., Erakor Id, Vanuatu; NHM 1997.10.6.18., Erakor Id, Vanuatu. Reef Flat; NHM 1997.10.6.15., Carter Reef, Great Barrier Reef, Australia; NHM 1997.10.6.16., Suva Barrier Reef, Fiji. Reef Flat; NHM 1997.10.6.23., Suva Barrier Reef, Fiji.

Description

Colony encrusting, unilaminar. Autozooids irregularly oval to hexagonal, separated by shallow grooves. Gymnocyst minimal; cryptocyst occupying slightly less than half total autozooid length, flat or slightly concave, coarsely beaded. Opesia subtriangular. At the distal end of each autozooid a pair (rarely one) of small, tear drop-shaped interzooidal avicularia. Rostrum acute to frontal plane, directed distally or disto-medially, with an acutely triangular mandible articulated on condyles. Large vicarious avicularia also present, generally larger than autozooids; rostrum raised distally, cryptocyst, narrow, coarsely granular, laterally constricted; opesia rounded; mandible spatulate, articulated on pointed, triangular condyles, angled slightly proximally, situated proximal to lateral rostral constriction. Ovicells endozooidal, small, granular, cap-like, derived from distal zooid. Ovicell not closed by

Measurements (mm): mean±standard deviation

Specimen	n	Autozooid Length	Autozooid Width	Opesial Length	Opesial Width	Avic. Length
NHM 1997.10.6.1. Holotype.	20	0.45±0.06	0.28±0.04	0.20±0.03	0.18±0.03	0.09±0.02

Specimen	n	Vic. Avic. Length	Vic. Avic. Width
NHM 1997.10.6.1. Holotype.	6	0.6 ± 0.06	0.27 ± 0.02

operculum. Mural septula present in the thin lateral walls, which may be strengthened by basolateral buttresses.

Remarks

Parantropora penelope looks superficially very similar to *A. typica*. However, it differs in its lack of a gymnocyst, its smaller opesia and in having large spatulate vicarious avicularia. *P. penelope* is distinguishable from *P. laguncula* by its smaller, more triangular opesia and more acutely pointed interzooidal avicularia.

The specimen figured by Ryland and Hayward (1992) as *Antropora granulifera* is certainly not Hincks's species; it is possible that *P. penelope* is the species figured, although its identity must remain uncertain until their material can be re-examined.

Distribution

Great Barrier Reef, Australia; Erakor Islands, Vanuatu; Suva Barrier Reef, Fiji.

This species appears to be limited to the tropical south west Pacific.

Parantropora laguncula (Canu and Bassler, 1929)
(Fig. 3F; 4A,B)

?*Biflustra savartii* Audouin, *var.* MacGillivray, 1891: 79, pl. 9, fig. 6.

?*Membranipora savarti*: MacGillivray, 1895: 38, pl. 5, figs 6,7.

Antropora marginella Harmer, 1926 (in part): 234, pl. 14, fig. 15.

Membrendoecium savarti Canu and Bassler, 1929: 94, pl. 6, figs 1–3.

Membrendoecium lagunculum Canu and Bassler, 1929: 96, pl. 6, figs 6–11.

Antropora lagunculum Mawatari and Mawatari, 1981: 33.

Material examined

Holotype Series: USNM 7869 (5 pieces), Alb. Sta. 5478, off Tacbuc Point, E Leyte, Philippines. 57 fathoms.

Other material examined: NHM 1997.10.6.5–7., Tideway Reef, Great Barrier Reef. 10m; NHM 1997.10.6.24., ?Mourilyan Harbour, Coll. Bob Pearson; NHM 1931.12.30.19. (as *Membrendoecium lagunculum*), Alb. Sta. 5478, off Tacbuc Str., E Leyte, Philippines. 57 fathoms. (exc. USNM); NHM 1931.12.30.14. (as *Membrendoecium savarti*), Alb. Sta. 5151, off Sirun Id, Tawi-tawi Is, Philippines. 24 fathoms. (exc. USNM); NHM 1931.12.30.15. (as *Membrendoecium savarti* var. *minor*), Alb. Sta. 5151, off Sirun Id, Tawi-tawi Is, Philippines. 24 fathoms. (exc. USNM); NHM 1928.9.13.19. (as *Antropora marginella*), Torres Straits, Australia; NHM 1928.3.6.50. (as *Antropora marginella*), Siboga Station 81. Borneo Bank, Strait of Makassar, Malaysia. 0–34m; NHM 1928.3.6.51. (as *Antropora marginella*), Siboga Station 164. W. of N. end of New Guinea. 32m.

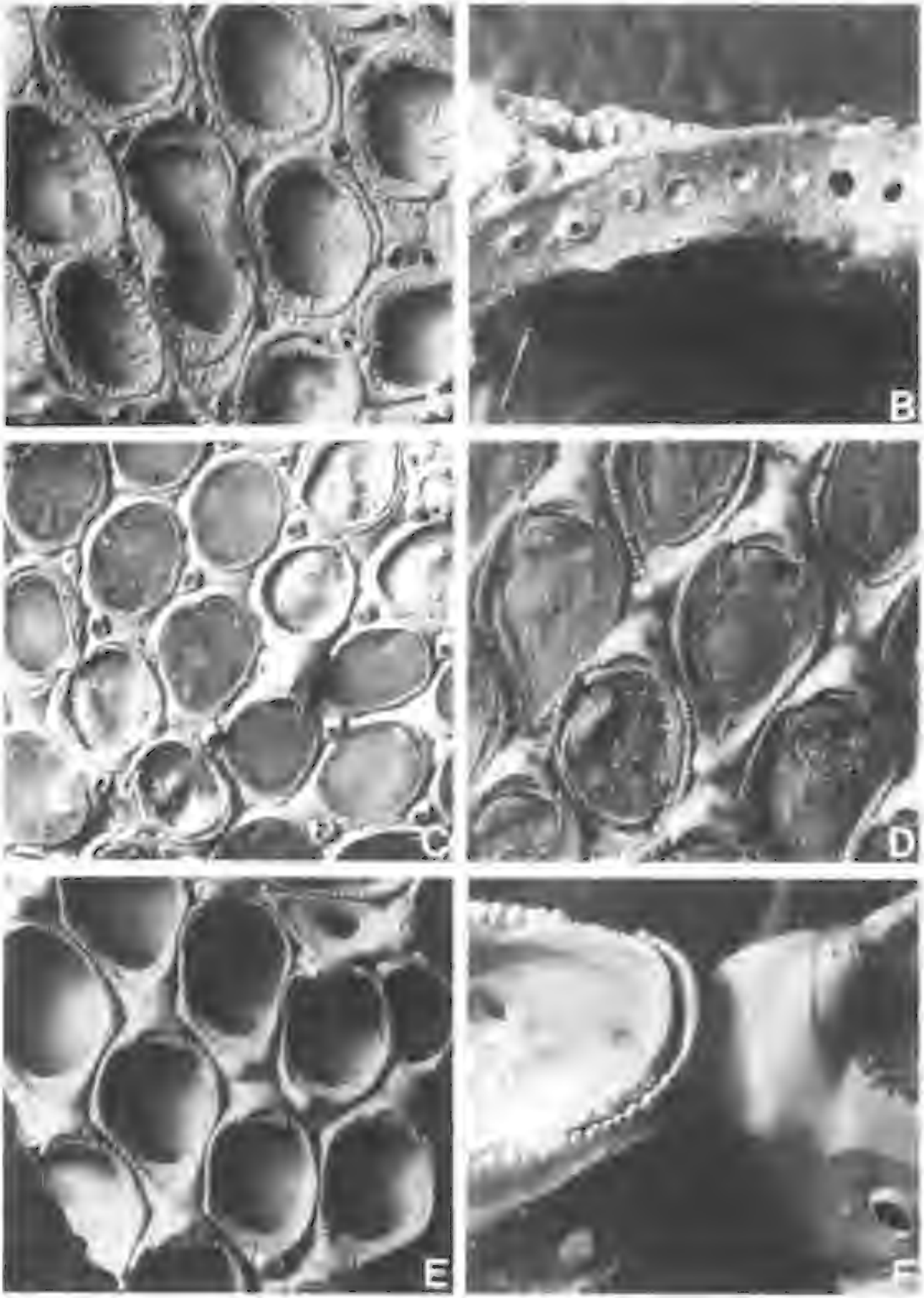
Description

Colony encrusting, unilaminar. Autozooids distinct, elongated or elliptical, separated by deep grooves. Gymnocyst reduced, surrounding zooids; cryptocyst coarsely granular, broadest proximally. Opesia elliptical or oval, occupying almost entire frontal area. Small, symmetrical, interzooidal avicularia are present at the interzooidal angles. Rostrum raised; mandible rounded-triangular, opesia with lateral constriction. Large vicarious avicularia frequent. Ovicells endozooidal, very small, smooth, raised cap-like.

Remarks

Parantropora laguncula is distinguished by its large oval opesia surrounded by a reduced gymnocyst.

According to Canu and Bassler (1929), MacGillivray (1891) recorded this species from


B
C
D
E
F

Measurements (mm): mean±standard deviation

Specimen	n	Autozooid Length	Autozooid Width	Opesial Length	Opesial Width	Avic. Length
C and B (1929) (*M. savarti*)	–	0.40–0.42	0.30	0.24–0.29	0.16–0.20	–
NHM 1997.10.6.5.	25	0.39±0.08	0.33±0.04	–	–	0.07±0.01

Specimen	n	Vic. Avic. Length	Vic. Avic. Width
NHM 1997.10.6.5.	8	0.62±0.08	0.32±0.06

the Tertiary of Victoria and the Recent of Western Australia, attributing it to *Biflustra savartii* Audouin. However, the figure accompanying MacGillivray's (1891) description bears little resemblance to *Parantropora laguncula*, here described. Canu and Bassler (1929) reported *Membrendoecium savarti* from the Philippines, attributing the specific name to MacGillivray whilst changing the generic attribution. In the same paper (Canu and Bassler 1929) they describe a new species, *Membrendoecium lagunculum*, which, following comparison of material of both species deposited in the Natural History Museum, London, proves to be identical to *B. savarti sensu* MacGillivray *non* Audouin. The combination *Parantropora laguncula* (Canu and Bassler, 1929) is consequently the correct name for this species.

Canu and Bassler (1929) noted that autozooid size in *Membrendoecium lagunculum* was variable and considered it to be dependent on substratum type, with autozooids at the margins generally largest, although they do not provide any measurements for this species. They did not describe large vicarious avicularia, seen in the type series of *Membrendoecium lagunculum*, despite their depiction in three of the figures (Canu and Bassler 1929: pl. 6, figs 6, 8 and 11); instead these were described as large aberrant zooids, with 'deformed' opesia, at the start of new autozooid series; the mandibular articulatory condyles can be clearly seen in their fig.11.

Silén (1941) considered that *Membrendoecium lagunculum* and *Antropora marginella* might prove to be a single species, by reference to Canu and Bassler's (1929) plate 6, figs 6–11 and Harmer's (1926) plate 14, fig. 15. Re-examination of Harmer's material of *Antropora marginella* shows that three specimens could be attributed to *P. laguncula*, namely NHM 1928.9.13.19. Torres Straits, Australia, NHM 1928.3.6.50. from Malaysia and NHM 1928.3.6.51. from New Guinea.

Distribution

Leyte and Tawi-tawi Is, Philippines; Torres Straits, Australia; Strait of Makassar, Malay; New Guinea; Great Barrier Reef.

This species is known from the Indo-Malaysian region and Western Australia and perhaps occurs more widely in the Southwest Pacific.

Genus ***Retevirgula*** Brown

Retevirgula Brown, 1948: 109.

Generic diagnosis

Colony thinly encrusting. Zooids united by

FIGURE 4. **A**, *Parantropora laguncula* (Canu & Bassler, 1929), NHM 1997.10.6.5., Tideway Reef, Great Barrier Reef, Australia. Group of zooids with thin cryptocystal rim and reduced gymnocyst (large vicarious avicularium visible in the centre). x45. **B**, *Parantropora laguncula* (Canu & Bassler, 1929), NHM 1997.10.6.7., Tideway Reef, Great Barrier Reef, Australia. Lateral wall showing septula. x144. **C**, *Retevirgula aggregata* Gordon, 1984, NHM 1928.9.13.18., Torres Straits, Australia. Group of zooids showing the deep separating grooves, small raised interzooidal avicularia and large globular keeled ovicell. x45. **D**, *Crassimarginatella papulifera* (MacGillivray, 1892), NHM 1881.10.21.355–9., Torres Straits, Australia. Group of zooids including ovicellate zooids, in which the operculum does not close the unifenestrate ovicell. x63. **E**, *Crassimarginatella papulifera* (MacGillivray, 1892), NHM 1881.10.21.355–9., Torres Straits, Australia. Group of zooids; note the presence of kenozooids. x45. **F**, *Crassimarginatella papulifera* (MacGillivray, 1892), NHM 1881.10.21.355–9., Torres Straits, Australia. Lateral view of two autozooids showing the mural pores and proximal papillae. x162.

short connecting tubes absent in some species. Opesia extensive, gymnocyst and cryptocyst reduced. Interzooidal avicularia common, sometimes replaced by kenozooids. Ovicells recumbent, smooth-walled or with a fenestra, often surmounted by an avicularium. Basal pore-chambers wanting. (Gordon 1984).

Type species

Membranipora acuta Hincks, 1885: 249, pl. 7, fig. 6.

Retevirgula aggregata Gordon, 1984
(Fig. 4C)

Antropora marginella Harmer, 1926 (in part): 234, pl. 14, fig. 15.

Retevirgula aggregata Gordon, 1984: 27, pl. 2, fig. D.

Retevirgula aggregata: Gordon, 1986: 30.

Material examined

NHM 1928.9.13.18. (as *Antropora marginella*), Torres Straits, Australia.

Description

Colony encrusting, unilaminar. Autozooids oval or rounded, distinct, separated by deep grooves. Gymnocyst minimal; cryptocyst granular, forming a very narrow rim; opesia rounded, occupying almost entire frontal area. Small interzooidal avicularia often found in the interzooidal angles; rostrum raised, rounded; mandible semicircular, distally directed. Kenozooids also present. Ovicells hyperstomial, smooth, globular, with a median suture, no fenestra.

Measurements (mm): mean±standard deviation

Specimen	n	Autozooid Length	Autozooid Width
Gordon (1984).	–	0.45–0.55	0.27–0.33
NHM 1928.9.13.18.	30	0.41±0.04	0.30±0.04

Remarks

In his account of *Antropora marginella*, Harmer (1926) described prominent, hyperstomial ovicells, with distinct median keels, in some specimens, referring in particular to specimen NHM 1928.9.13.18 from the Torres Straits. Such ovicells are not a feature of *Antropora* and re-examination of the specimen shows it to be attributable to the recently described *Retevirgula aggregata* Gordon, 1984.

Gordon (1984) distinguished his new species from other species of *Retevirgula* Brown, 1948, by the absence of connecting tubes and avicularian pivot bars (*R. aggregata* possesses condyles instead), both included in Brown's (1948) original generic diagnosis.

Distribution

Described by Gordon (1984) from Kermadec Ridge (type locality Curtis Is) and off Kahurangi Point, north-west South Island, New Zealand; this new record from Torres Straits, NE Australia suggests a considerable geographical range in the SW Pacific.

Genus ***Crassimarginatella*** Canu

Crassimarginatella Canu, 1900: 369.

Oochilina Norman, 1903a: 595.

Generic diagnosis

Colony encrusting, or erect from an encrusting base. Gymnocyst variable in extent, usually reduced. Opesia extensive, occupying the larger part of the frontal area; cryptocyst reduced, moderate or very narrow. Avicularia vicarious, lacking spines, with or without a pivot bar. Ovicells prominent, unifenestrate, or small and cap-like. Mural or basal pore-chambers present (cf. Harmelin 1973). (Gordon 1984).

Type species

Membranipora crassimarginata Hincks, 1880a: 71, pl. 9, fig. 1–1a.

Crassimarginatella papulifera (MacGillivray, 1882)
(Fig. 4D–F)

Membranipora papulifera MacGillivray, 1882: 116, fig. 9.

Membranipora papulifera: Waters, 1898: 658, 659, 660, 669.

Crassimarginatella papulifera Brown, 1952: 56, fig. 13.

Crassimarginatella (*Crassimarginatella*) *papulifera* Gordon, 1986: pl. 4F.

Material examined

NHM 1881.10.21.355–9., (as *Membranipora* sp.), Torres Straits, Australia, HMS Alert.

Description

Colony encrusting, unilaminar. Autozooids distinct, elongate, separated by deep grooves. Frontal membrane bordered by a thin crenellated mural rim. Gymnocyst minimal, sometimes papillate proximally; cryptocyst finely beaded, minimal, broader proximally than laterally, sloping basally. Opesia oval, very large, equivalent to 80–90% of frontal area. Ovicells, smooth, cap-like, slightly pointed, hyperstomial, unifenestrate, with at least some material being derived from the gymnocyst of distal autozooid. Operculum broad, does not cover ovicell orifice. Interzooidal communication by mural dietellae. No spines.

Measurements (mm): mean±standard deviation

Specimen	n	Autozooid Length	Autozooid Width
Brown (1952)	–	0.51–0.55	0.33–0.38
NHM 1881.10.21.355–9.	30	0.60±0.05	0.33±0.03

Remarks

The most striking feature of this species is the form of the ovicell, from which the specimen described above was identified using the plate published by Gordon (1986) of paralectotype material.

Norman (1903a) referred *Membranipora papulifera* MacGillivray, 1882, to his new genus *Oochilina*. However, this genus shared the same 'genotype' species, *Membranipora crassimarginata* Hincks, 1880a, with *Crassimarginatella* Canu, 1900, which therefore takes precedence.

Gordon (1986), in his discussion of *Crassimarginatella* (*Crassimarginatella*) *fossa* Uttley, 1951, assigned *Crassimarginatella papulifera* (MacGillivray, 1882) to the subgenus *Crassimarginatella* but now (Gordon, pers. comm.) regards each of the subgenera of *Crassimarginatella* as deserving generic status. This species is thus correctly *Crassimarginatella papulifera* (MacGillivray, 1882). Waters (1898), Brown (1952) and Gordon (1986) all record the presence of vicarious avicularia, but these have not been seen in the specimen described above, although there appears to be evidence of autozooidal regrowth, i.e. multiple occupancy of a single autozooidal skeleton.

Distribution

Port Phillip Heads, Victoria; Torres Straits, Australia; New Zealand (fossil).

Discussion

Several other species that have formerly been assigned to *Antropora* Norman, 1903b have also been examined and found to have been wrongly attributed. Harmer (1926) attributed *Membranipora nigrans* Hincks, 1882 to *Antropora*, but examination of material of this boreal species (Holotype: NHM 1886.3.6.9., Queen Charlotte Id, Canada; NHM 1911.10.1.610,611., Spitzbergen?; NHM 1919.6.25.40., Spitzbergen?; NHM 1938.11.30.25., off Del Monte, California; NHM 1955.10.3.63., Greenland), shows that Canu and Bassler (1929) and Cook (1968a) were correct in expressing doubts about the congeneric status of *Membranipora nigrans* and *A. granulifera* (see further discussion in Prenant and Bobin 1966).

Membrendoecium japonicum Canu and Bassler, 1929, automatically placed in *Antropora* by the synonymy of *Membrendoecium* Canu and Bassler and *Antropora* by Silén (1941), is not a species of *Antropora*. Examination of original material (NHM 1931.12.30.18., Cape Tsiuka, Japan) shows the regular form of kenozooids in the autozooidal framework, a feature more similar to species of *Menipea* Lamouroux, 1812 (a genus of erect species) than to *Antropora sensu stricto* (which are all encrusting, although see Silén's (1941) description of *A. erecta*) but this is not its true generic assignment either.

Gordon (1986) amended Norman's (1903b) generic diagnosis of *Antropora* when describing his new species *Antropora pacifera*. This species was also examined (Paratype: NHM 1985.1.22.2., NZOI Stn B488.); it completely lacks avicularia, and the ovicells are not endozooidal, but larger, separate structures, that have an obvious ectooecial rim around the granular endooecium, a distinct feature of the genus *Alderina* Norman, 1903a (Gordon, 1984).

It may transpire that several of the unexamined species listed above (see generic introduction) will be synonymised with one or more of the species described herein but until original material has been located the validity of these species cannot be tested.

The genus *Antropora* is presently placed within the Family Calloporidae Norman, 1903a; however, as Ryland and Hayward (1977) conclude 'this is a somewhat heterogeneous group'. The genera assigned to the family Calloporidae would thus benefit from a full systematic investigation. The familial diagnosis of Calloporidae emphasises the presence of prominent hyperstomial ovicells.

The genera *Antropora* and *Parantropora* gen. nov., have small endozooidal ovicells which would suggest that they belong to a family other than the Calloporidae.

Soule, Soule and Chaney (1995) discuss the Calloporidae, concluding that the Hincksinidae Canu and Bassler, 1927, should be reinstated for membraniporines with endozooidal ovicells and Alderinidae Canu and Bassler, 1927, for those with hyperstomial ovicells. However, the type genus of Hincksinidae, *Hincksina* Norman, 1903a is generally assigned to the Flustridae Fleming, 1828 (Ryland and Hayward 1977), and this proposal is thus unacceptable.

Vigneaux (1949) introduced the Antroporidae for *Antropora* Norman, 1903b, *Ogivalina* Canu and Bassler, 1917, *Ogivalia* Jullien, 1882 and *Rectonychocella* Canu and Bassler, 1917, splitting it into two subfamilies, with *Antropora* the only genus in the Antroporinae. The adoption of Vigneaux's (1949) scheme would ease the problem; *Crassimarginatella* would fall within the Alderinidae Canu and Bassler, 1927, as would *Retevirgula*, but the exact familial assignment of *Parantropora* is as yet unclear.

The genus *Antropora* has a global distribution predominantly in the tropics. However, the type species, *A. granulifera* occurs from the warm temperate waters of the Atlantic to the tropical seas of the Pacific. Several other species, *A. typica*, *A. minor* and *A. tincta*, are found globally occurring in both warm temperate and tropical seas. The remaining species have more narrow geographical ranges; *A. subvespertilio* has a disjunct range in the Gulf of Mexico and the Philippines, whereas *A. erectirostra* has only been found from Sri Lanka. The two species of the new genus *Parantropora* appear to be limited to the tropical south-west Pacific, from the Indo-Malaysian region to the Great Barrier Reef and Fiji.

List of Fossil Species not covered in this paper.

Antropora daishakaensis Kataoka, 1957

Antropora elongata Kataoka, 1957

Antropora hataii Kataoka, 1957

Dacryonella minor Canu and Bassler, 1920

Dacryonella octonaria Canu and Bassler, 1917

Dacryonella octonaria minor Canu and Bassler, 1920

Dacryonella (*Homalostega*) *pavonia* (Marsson, 1887)

Dacryonella (*Reptescharinella*) *transversa* (d'Orbigny, 1852)

Dacryonella (*Homalostega*) *vespertilio* (Marsson, 1887)

Membrendoecium duplex Canu and Bassler, 1920

Membrendoecium lowei Canu and Bassler, 1920

Membrendoecium pyriforme Canu and Bassler, 1917

Membrendoecium rectum Canu and Bassler, 1920

Membrendoecium transversum Canu and Bassler, 1920

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THE SKULL OF DROMORNITHID BIRDS : ANATOMICAL EVIDENCE FOR THEIR RELATIONSHIP TO ANSERIFORMES

PETER F. MURRAY & DIRK MEGIRIAN

Summary

Dromornithid cranial material from the mid and late Miocene Bullock Creek and Alcoota Local Faunae of the Northern Territory of Australia provides sufficient morphological data on which to base an opinion on their wider phylogenetic relationships. While the appendicular elements of dromornithid birds have previously been considered to show some similarities to those of living and extinct ratite birds, no common traits are evident on the cranium. The basipterygoid facets are large, flat surfaces closely applied to the basisphenoid rostrum. A transverse prokinetic craniorostral joint is present, the quadrates are mobile and the pterygopalatine joint is patent and condylar. Though many features of the dromornithid skull are unique to the family, structure and relations of the parasphenoidal rostrum are basipterygoid processes, morphology of the pterygopalatine joint, relations of the temporal fossa and form of the postorbital process, presence of large, oval fossae for the origin of the levators and protractors of the pterygoquadrate, basic form and presence of an anterolateral crest on the otic process of the quadrate and elongated post-tympanic crests and retroarticualr processes indicate a close relationship with anseriform birds.

THE SKULL OF DROMORNITHID BIRDS: ANATOMICAL EVIDENCE FOR THEIR RELATIONSHIP TO ANSERIFORMES

PETER F. MURRAY & DIRK MEGIRIAN

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Known since 1839, the gigantic birds of the family Dromornithidae have been described and classified almost exclusively on the basis of their postcranial anatomy (Rich 1979). Two partial skulls of *Genyornis newtoni* were described by Stirling and Zietz (1913) but with the exception of the quadrates and some parts of the upper and lower jaws, the specimens were in such poor condition that they only provided an indication of their shape and proportions. More recently, some undescribed dromornithid specimens recovered from the mid Miocene Bullock Creek Local Fauna and the late Miocene Alcoota Local Fauna of the Northern Territory, Australia, led Rich (1991:740) to conclude that '...the skull structure is so highly derived, it is difficult to associate with any known avian group.'

Dromornithids comprise five known genera and at least seven species of flightless birds endemic to Australia. Their diversity in size and form is comparable to that of New Zealand's Moas (Dinornithidae-Emeidae), ranging from Ostrich-sized *Ilbandornis* to the gigantic *Dromornis stirtoni* which weighed over a half a tonne (Rich 1979). Many of these species are represented by abundant and well-preserved post-cranial material, but the cranial and mandibular fossils, though not uncommon, have apparently been considered to be inadequate for description and analysis. Rich's (1979, 1980) detailed study of the postcranial skeleton of dromornithids shows that all species were ground-birds with keel-less sterna, extremely reduced wings, long flexible necks, and hind limbs adapted for cursorial locomotion, thus generally resembling large living ratites such as Emus, Ostriches and Rheas and extinct ratites such as Elephant birds and Moas.

Dromornithids are known from Eocene through to late Pleistocene sediments widely distributed in Australia (Vickers-Rich and Molnar 1996, Field and Boles 1998). Their diversity was apparently greatly diminished after the early to mid Pliocene, subsequent to which, the family is represented by only one species, *Genyornis newtoni*. Rich (1979) provides a detailed and interesting account of the history of discovery of dromornithids to which we refer the reader.

We describe, illustrate and compare some of the cranial material collected between 1985 and 1996 by Northern Territory Museum expeditions to the Bullock Creek and Alcoota fossil vertebrate fossil localities in the Northern Territory. We believe that these specimens provide sufficient anatomical information to identify their position within the current avian systematic framework. Because of the many unique and interesting features of the

dromornithid skull, we have briefly examined some aspects of its functional anatomy and have attempted to reconstruct the appearance as well as some aspects of the palaeobiology of the species. However, as the skulls of the Dromornithidae have not been previously described in detail, we have concentrated primarily on providing adequate anatomical detail for further analysis, pointing to certain areas in which this information may find application.

Key Words: Dromornithidae, avian cranial anatomy, ratite birds, *Diatryma*, Anseriformes, Anhimidae, avian paleobiogeography

Methods And Materials

Due to its extreme fragility, Bullock Creek dromornithid cranial material from Camfield Beds limestone was partially extracted with dilute acetic acid and finally prepared by hand. Alcoota Local Fauna dromornithids, extracted from Waite Formation silty and sandy sediments, were prepared in the field using Synocryl diluted in acetone. The dromornithid material was compared with the following specimens of extant species prepared using water maceration and ammonia methods: Struthioniformes, *Struthio camelus* (Ostrich) late embryo, 4-week old chick, 3-month old chick; *Dromaius novaehallandiae* (Emu) 6 week old chick, two adults; Galliformes, *Gallus gallus* (Domestic fowl) two-week old chick; *Megapodius reinwardt* (Orange-footed scrub-fowl) 1 hatchling, 1 adult; Anseriformes, *Anseranas semipalmata* (Magpie goose), *Anas* spp. (domestic ducks), *Anas superciliosa* (Pacific black duck), *Malacorhynchus membranaceus* (Pink-eared duck), *Anser sp.* (domestic gosling); Procellariiformes, *Puffinus tenurostris* (Short-tailed shearwater); Pelecaniformes, *Phalacrocorax sulcirostris* (Little black cormorant), *Pelecanus conspicillatus* (Australian pelican); Ciconiiformes, *Ardea sp.* (egret), *Threskiornis spinicollis* (Straw-necked ibis); Falconiformes, *Aquila audax* (Wedge-tailed eagle), *Falco berigora* (Brown falcon); Gruiformes, *Eulabeornis castaneoventris* (Chestnut rail), *Gallinula mortierii* (Tasmanian native-hen); Turniciformes, *Turnix velox* (Little button-quail); Charadriiformes, *Burhinus grallarius* (Bush stone-curlew), *Larus novaehollandiae* (Silver gull); Columbiformes, *Geophaps plumifera* (Spinifex pigeon), *Geopelia cuneata* (Diamond dove); Psittaciformes, *Calyptorhynchus banksii* (Red-tailed black cockatoo), *Cacatua roseicapilla* (Galah); Cuculiformes, *Centropus phasianinus* (Pheasant coucal); Strigiformes, *Ninox connivens* (Barking owl), *Ninox novaeseelandiae* (Southern boobook), *Tyto alba* (Barn owl); Coraciiformes, *Dacelo leachii* (Blue-winged kookaburra); *Eurystomus orientalis* (Dollarbird); Passeriformes, *Corvus sp.* (crow). Systematics of extant species follow Christidis and Boles (1995). Musculoskeletal relations were confirmed by dissection of the heads of Magpie goose and Chestnut rail preserved in alcohol. Observations on the development of basipterygoid processes in struthioniform, galliform and anseriform birds were made on embryos and chicks of Ostrich, domestic fowl and domestic goose. Comparative anatomical information was supplemented by Bock (1963), DeBeer (1957), Goodrich (1955), Heilmann (1926), Huxley (1867), McDowell (1948) Pycraft (1901) and Simonetta (1960).

Systematics

Class AVES

Subclass NEORNITHES

Order ANSERIFORMES

Family DROMORNITHIDAE Fürbringer 1888

Genus ***Bullockornis*** Rich 1979

Bullockornis planei Rich 1979

Referred material: cranium with basipterygoid processes P9464–106; cranial fragments P907–6, P9612–1, P9464–110, P9464–111; upper beak fragments, P9464–107, P9464–108, P907–28; ?nasal septum fragment, P87113–38; mandibles, P9464–112 , P9464–113, P9464–114, P9464–116; vomeropalatine fragment, P9464–115; left ?pterygoid fragment, P87103–43; right ?pterygoid fragment, P9464–101; left quadrates, P9464–100; P9464–118.

Locality: Bullock Creek, Northern Territory, Australia. Low limestone hill 1 km east of type section of Camfield Beds, 131°31'20"E, 17°07'S, Wave Hill (1:250 000), SE 52–8.

Lithic unit and age: Camfield Beds, middle Miocene.

Fauna: Bullock Creek Local Fauna.

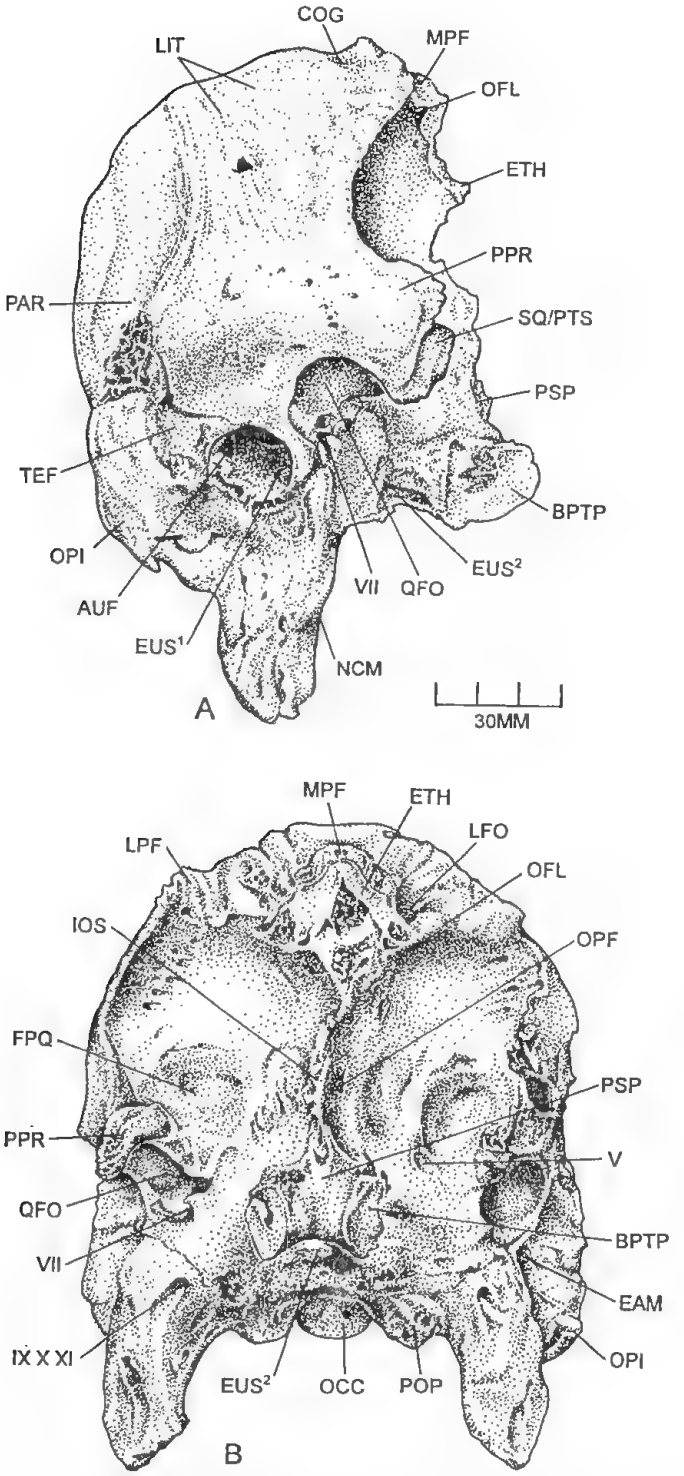


FIGURE 1. Cranium of *Bullockornis planei* (P9464–106); **A**, lateral aspect, **B**, anterior aspect. Abbreviations: AUF, auditory fenestra (*cavum auditivum*); BOC, basioccipital; BPTP, basipterygoid process; COG, coronal groove (capsule of cranio-rostral joint); EAM, external auditory meatus; ETH, ethmoid; EUS^1, external opening of eustachian canal; EUS^2, internal opening of eustachian canal; FMA, foramen magnum; FR, frontal; ?IPA, ?interparietal; IOS, interorbital septum; IX X XI, cranial nerves; LFO, lateral fossa or sinus; LIT, ligament tracts of cranio-rostral joint; LPF, lateral process of frontal; MPF, median process of frontal; NCM, "mastoid" process of opisthotic or neurocranio-mandibular process; OCC, occipital condyle; OFL, orbital flange; OPF, optic foramen; OPI, opisthotic (post-tympanic crest); PAR, parietal; POP, paroccipital process; PPR, postorbital process; PSP, parasphenoid; QFO, quadrate fossa; SOC, supraoccipital; SQ/PTS, squamosal and pterosphenoid components of zygomatic process; TEF, temporal fossa; V, foramen for trigeminal nerve (mandibular and maxillary branches) VII, foramen or notch for facial nerve; FPQ, fossa for mm. protractor quadratus and pterygoideus ('pterygoid fossa'); XII, hypoglossal nerve foramen.

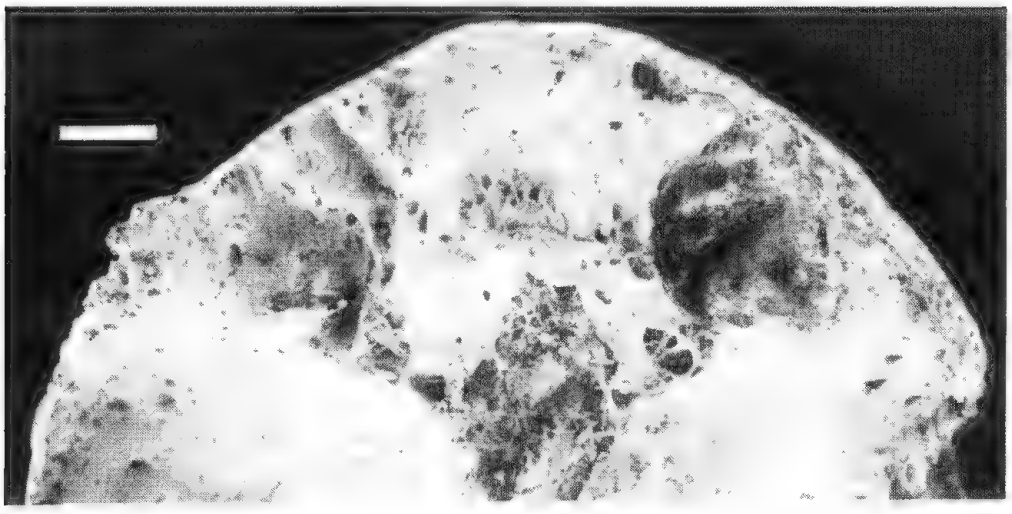


FIGURE 2. Photograph of frontal aspect showing cranio-rostral joint surface of *Bullockornis planei* (P9464–106). Scale bar equals 1 cm.

Description:

Cranium. The frontals, parietals, interparietal and occipitals form a nearly hemispherical vault over the orbits. (Fig. 1) The cranial walls are composed of a thin compactum overlying diploeic bone; attaining a thickness of 35–40 mm between the inner table of the endocranial cavity and the outer table of the frontal on the mid-sagittal plane. Only the posterior half of the orbital margin is known. In all specimens the orbit is a shallow C-shaped notch with a thin, slightly roughened margin marked by numerous foramina on the outer and inner surfaces. Dorsolaterally, a shallow fossa containing large emissaries is located about 20 mm medial to the orbital margin.

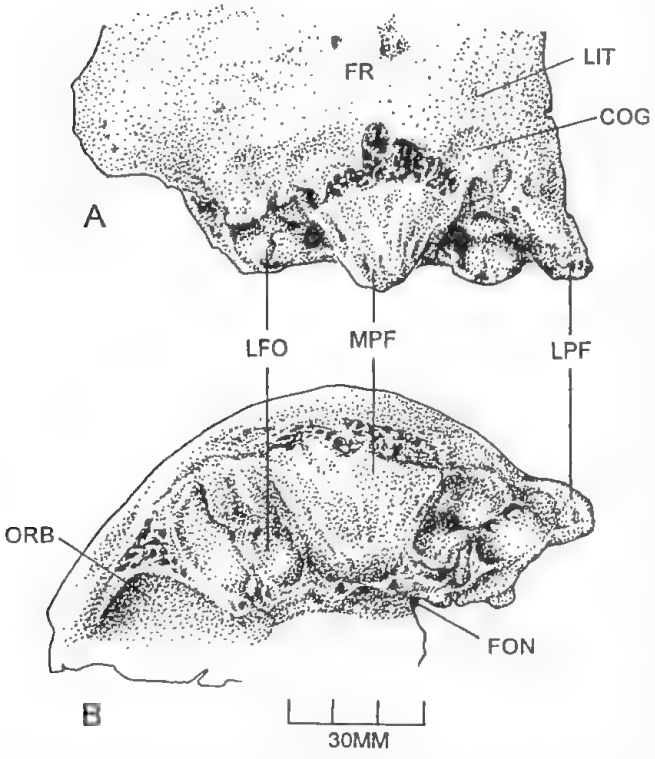


FIGURE 3. Drawing of cranio-rostral joint surfaces of *Bullockornis planei* (P907–6). **A**, dorsal; **B**, frontal aspect. Abbreviations: COG, coronal groove; FON, foramen for olfactory nerve; FR, frontal; LFO, lateral fossa; LIT, ligamentous tracts; LPF, lateral process of frontal; MPF, median process of frontal; ORB, orbit.

A series of circular indentations situated immediately behind the anterior frontal margin are associated with a ligamentous joint capsule, securing the fronto-ethmoid to the rostrum (Figs 1A, 2, 3A,B). The anterior orbital margin terminates in blunt process of variable width and length, forming the lateral wall of a pair of internally rugose, oval fossae situated on either side of a prominent, triangular median eminence of the frontal (Figs 1A,B, 2, 3A,B). A transverse groove at the base of the median frontal eminence corresponds to the dorsal margin of the ethmoid, which apparently encloses a median sinus, then narrows ventrally to merge with the interorbital septum. Breakage along these sutures occurs in all specimens in which the anterior part of the cranium is present.

The parasphenoidal crest of the interorbital septum is missing, but according to its section immediately anterior to the basipterygoid processes, it appears to have been a thin, V-shaped crest not much thicker than the interorbital plate. The optic and anterior lacerate foramina open on the dorsal margins of the orbital wall, separated by about 13 mm on either side of the interorbital septum (Figs 1B, 4A). Although variable in size and number, up

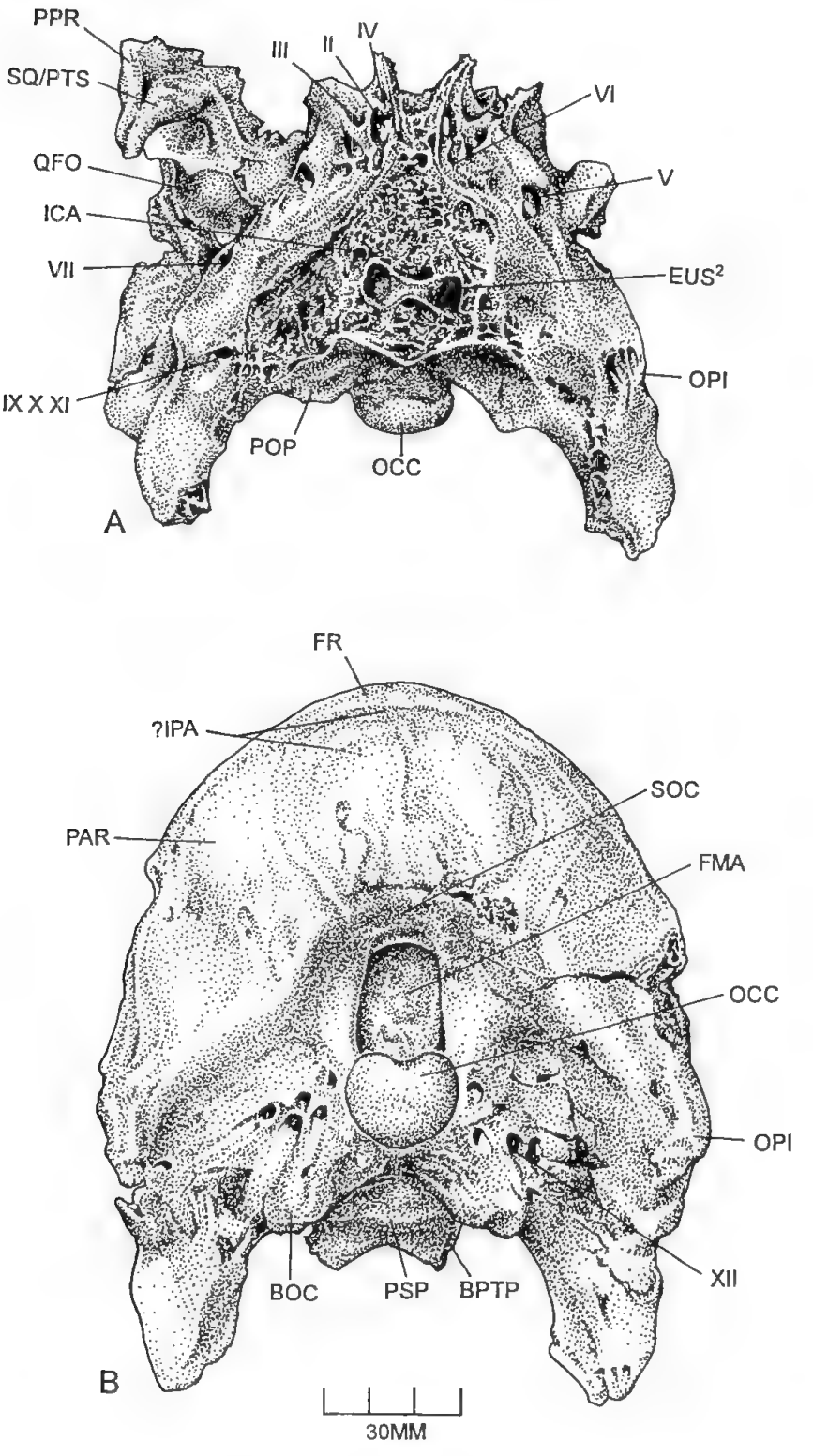


FIGURE 4. Cranium of *Bullockornis planei*; **A**, ventral aspect showing median position of conjoined eustachian canals (P907–6); **B**, posterior aspect (P9464–106). Abbreviations: EUS^2, internal eustachian canal opening; ICA, internal carotid artery foramen; II, optic nerve foramen; III, oculomotor nerve foramen; IV, trochlear nerve foramen; IX X XI, accessory, vagus and glossopharyngeal nerve foramen (posterior lacerate); LFO, lateral fossa (sinus) of frontal; LIT, ligament tracts of cranio-rostral joint capsule; LPF, lateral process of frontal; MPF, median process of frontal; OPI, opisthotic; ORB, orbit; POP, paroccipital process; PPR, postorbital process; QFO, quadrate fossa; SQ/PTS, squamosal/pterosphenoid components of postorbital process;V, trigeminal nerve foramen;VI, abducens nerve foramen; VII, facial nerve foramen.

to four small foramina surround the optic foramen. From anterodorsally to posteroventrally these are identified as: ophthalmic artery (dorsal notch in optic foramen) ophthalmic nerve (V^1), oculomotor nerve (III), abducens nerve (VI) and trochlear nerve (IV). A variable-sized foramen rotundum (V^2) opens immediately dorsoposterior to the abducens foramen; about 12 mm posterolateral to which is situated the large foramen ovale (V^3). On either side, about one centimetre lateral to external margin of the optic foramen are ~15 mm deep, oval pits about 15 mm x 20 mm wide representing the origins of the *mm. protractores et levatores quadratus + pterygoideus*. Extending ventrally from the posterolateral margin of these pits are short, broad postorbital processes composed of two fused elements (Figs 1A,B, 4A).

The inner element of this process appears to be composed of the squamosal eminence of the quadratic fossa and the laterosphenoid. Arising from the anterior margin of the quadrate fossa and widening distally, its terminal crest gives the appearance of having been twisted 90°. The inner (ventral) surface of the postorbital process is concave and functioned as an extension of muscle attachment area of the reduced temporal fossa. Closely applied to the laterosphenoid process is a thin, broad outer lamina of the posterior margin of the orbit that appears to arise from the lateral process of the squamosal, possibly overlapping the postorbital margin of the frontal. The fusion of these elements has displaced the temporal fossa posteroinferiorly to a circular depression extending from just above the auditory meatus, where the aponeurosis of the external adductor muscles originates from a strong crest, to the previously described pocket on the inferomedial side of the postorbital process.

The quadrate fossa is roundly oval, about 22 mm by 15 mm, with a smooth, solid articular surface. A slightly raised, oval articular eminence is visible in some individuals. A spinous process arises from the ventral margin for the anterior quadratic ligament which probably inserts into a long, deep groove on the anteromedial surface of the quadrate. The 20 mm diameter external auditory recess is approximately circular, enclosed in a deep, funnel-shaped orifice formed primarily by greatly expanded post-tympanic crests of the opisthotics. The eustachian and tympanic fenestrae, lying deep within the recess, are separated by a broad interfenestral process. The facial nerve passes through a variable foramen or notch situated near the posteroventral edge of the quadratic fossa. The large eustachian canals emerge confluently on the mid-line of the basitemporal plate, at the base of the parasphenoidal rostrum. Situated a short distance anterolaterally are the internal carotid foramina.

The basipterygoid or rostropterygoid (Weber 1993) facets are closely applied to the ventrolateral margins of the parasphenoidal rostrum. The smooth, 27 mm long by 19 mm wide, oval and slightly concave articular surfaces are situated 18 mm apart and protrude about 4 mm on either side of the eminence (Figs 1A,B, 6A,B). Shallow, arcuate grooves extend from the margins of the confluent eustachian openings to the posterior lacerate foramina, probably indicating the suture between the parasphenoid and basisphenoid. Posterolateral to the small basitemporal plate, the basioccipital is dominated by a pair of large conical paroccipital processes for the rectus capitus muscles. In some individuals in which the paroccipital processes are less prominent, deep oval fossae or rugose, elliptical muscle scars are present. A wide groove is formed between the paroccipital processes that continues forward onto the basisphenoid. Lateral to these are elongated, wing-like post-tympanic processes of the opisthotics. The bases of each, approximately 50 mm long neurocranio-mandibular process, bears a large posterior lacerate foramen (vagus foramen of Pycraft) on its anterior surface for nerves IX, X and XI.

The occipital surface of the cranium is deeply concave owing to the posterior sweep of the large post-tympanic crests of the opisthotics (Fig. 4B). Ventrolateral to the occipital condyle are multiple condylar (hypoglossal nerve) foramina emergent from deep condylar fossae. The occipital condyle is hemispherical, faintly notched on its dorsal margin and just perceptibly narrower ventrally. The foramen magnum is rectangular, about 17 mm wide by 25 mm high. The supraoccipital is broadly rectangular, above which a much smaller, though clearly defined oval structure, possibly representing an interparietal, is situated. Occipital fontanelles are absent. The parietals are crescentic, wedge-shaped bones meeting dorsally above the interparietals and bounded anteriorly by a strong lambdoidal crest. The suture of the anteroinferior process of the parietal is indistinct but appears to have sent a short process anteriorly over the squamosal. The frontal is short anteroposteriorly, narrowing anteriorly above the orbits, where it terminates in a blunt lateral process or eminence.

Endocranial cavity: The endocranial fossa is best represented on P907-6, in which the cranium is

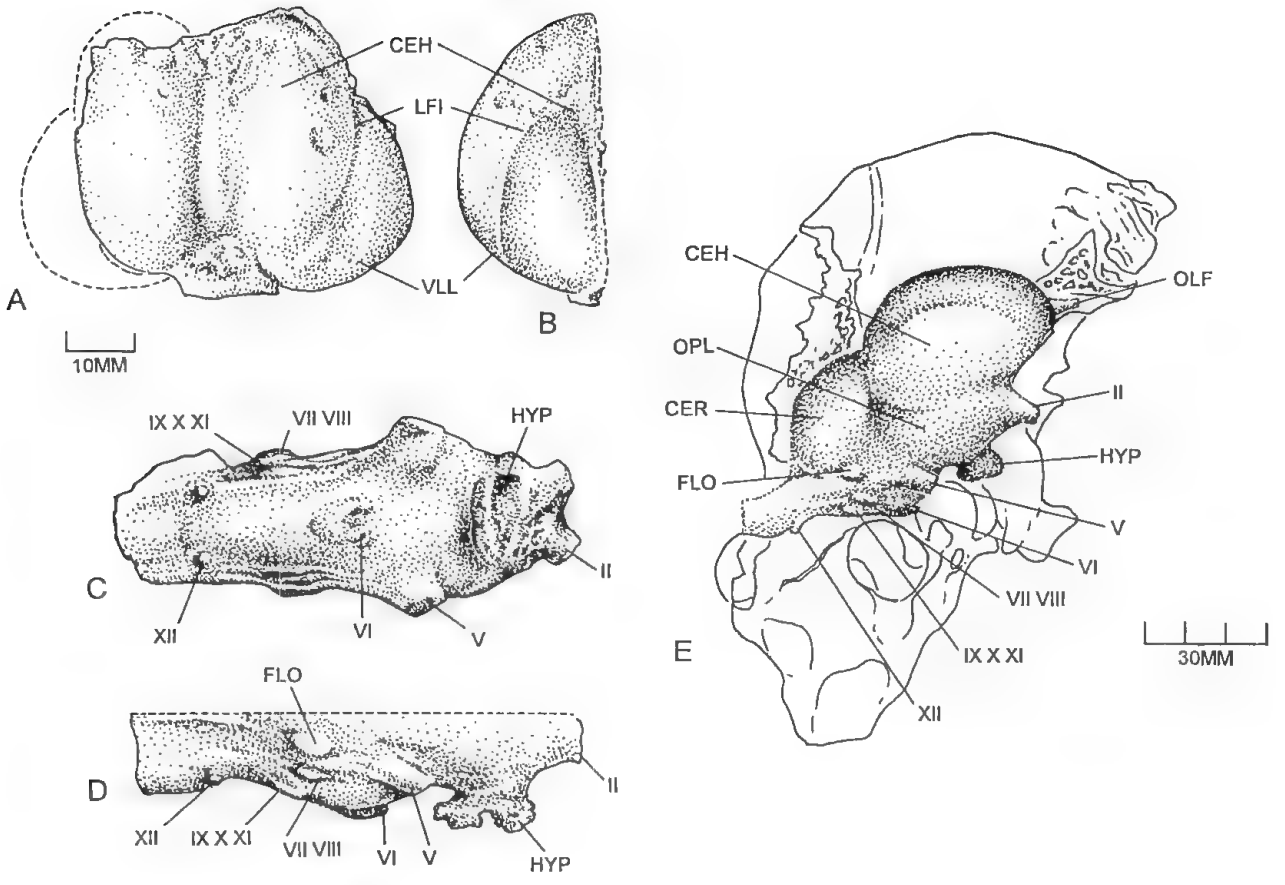


FIGURE 5. Endocranial structure of *Bullockornis planei* (P907–6); **A** & **B**, endocast of cerebral hemispheres, dorsal and lateral views; **C** & **D**, endocast of brainstem, ventral and lateral views; **E**, lateral aspect of reconstructed endocranial cavity. Abbreviations: CEH, cerebral hemisphere; CER, cerebellum; FLO, flocculus; HYP, hypophysis; II, optic nerve; IX X XI, accessory, vagus and glossopharyngeal nerve stumps; LFI, lateral fissure; OLF, olfactory nerve; OPL, optic lobe; V, trigeminal nerve stump; VI, abducens nerve stump; VII VIII, facial and acoustic nerve stumps; VLL, ventrolateral lobe of cerebrum; XII, hypoglossal nerve.

broken in half along the horizontal plane (Fig. 5A–E). A few millimetres of the base of the cerebral hemispheres are missing from the endocast, as the two pieces are slightly warped along the contact and do not join perfectly. The dimensions of the cerebral fossa are 44 mm long by 70 mm (estimated) wide and approximately 25 mm deep. The cerebral hemispheres are large, with the ventrolateral lobe greatly expanded transversely (Fig. 5A,B). The optic lobes are relatively small and tucked-in beneath the cerebral hemispheres (Fig. 5E). The brainstem is broad, considerably expanded at the base of the optic lobes to just behind the trigeminal stubs.

The hypophyseal fossa (*sella turcica*) is oval 12 mm x 9 mm by about 10 mm deep. The internal walls of the floor of the fossa of P907–6 have been breached resulting in a ragged cast (Fig. 5C,D). In P9612–1, where it is undamaged, it is circular, about 12 mm in diameter. The optic foramina commence immediately anterior to the *tuberculum sellae*, diverging laterally on either side of a 10 mm wide septum. The internal carotid foramen opens immediately anterior to the chiasmic sulcus. The trigeminal foramina are large 7 mm by 5 mm orifices situated 7 mm posterolateral to the margin of the hypophyseal fossa. Ventral to the trigeminal stubs is a broad pontine flexure, at the base of which is are the stubs of the abducens nerves. The internal auditory meatus for the facial and acoustic nerves is located in the ventral wall of the pro-otic 10 mm posterior to the trigeminal orifice. A large floccular fossa is located about 5 mm posterosuperior to the internal meatus, posteroventral to which is the large, slit-like foramen for nerves IX, X and XI. The nerve XII is located about 6 mm posterior to the former. Overall proportions of the medullary fossa are quite variable. It is short and broad in P9612–1 and long and narrow in P907–6.

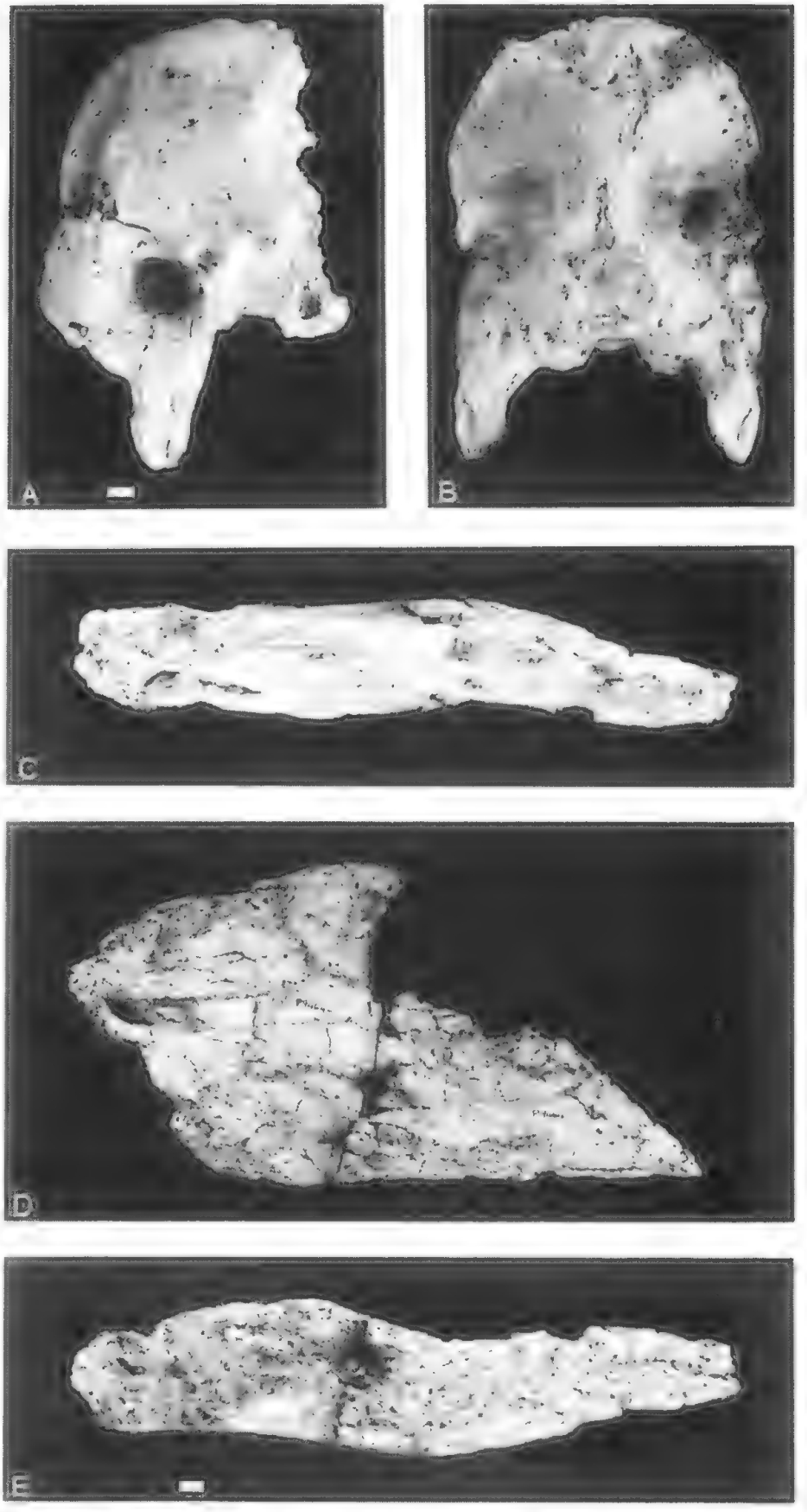


FIGURE 6. Photographs of neurocranium (P9464–106) and rostrum (P9464–107) of *Bullockornis planei*; **A** lateral aspect of neurocranium; **B** frontal aspect of neurocranium; **C**, upper beak, dorsal aspect; **D**, upper beak, lateral aspect; **E**, upper beak, palatal aspect; scale=1cm interval.

Rostrum. The rostrum or upper beak of *Bullockornis* is represented by a fragment 325 mm long, 174 mm deep and 58 mm maximum width (Figs 6C–E, 7A–C). The anterodorsal surface and about 25 mm of the tip of the beak are missing from the specimen. The beak is laterally compressed and extremely narrow. The culmen is a thin, arching crest about 10 mm wide at the apex, thickening gradually to about 21 mm width above the level of the external nares. In section, the beak is narrowly triangular with an elliptical internal cavity. A septal process in not apparent in mid-section. The palatal surface is shallowly concave posteriorly, becoming slightly more V-shaped in the anterior half. The palate is solid throughout, lacking a median palatal fenestra, though an imperforate elliptical fossa is present. The maxillopalatines are fused across the midline. The distal palatines are expanded into bulges of spongy bone that meet in the median sulcus anterior to the internal nares. Posteriorly, the palatines narrow into deep, vertical crests which have been crushed inwards on the specimen, obscuring other details in the region. A rhinothecal groove commences behind the decurved section of the tip: anteriorly as a narrow, ventrally-directed, U-shaped sulcus; posteriorly becoming wider, shallower and more laterally-directed. The width and angle of this groove is the reciprocal of the gnathothecal crest of the

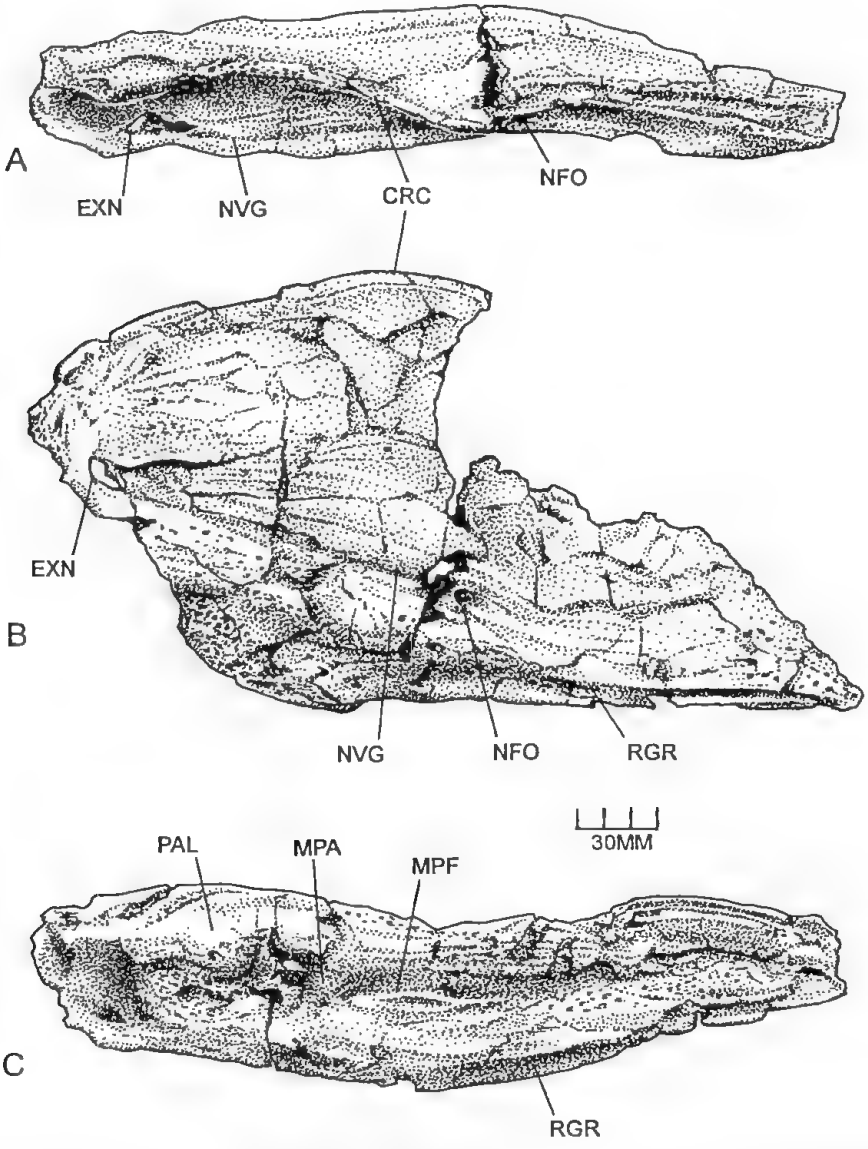


FIGURE 7. Drawings of *Bullockornis planei* rostrum (P9464–107); **A**, dorsal aspect; **B**, lateral aspect; **C**, palatal aspect. Abbreviations: CRC, crest of culmen (premaxilla); EXN, external nares; MPA, maxillopalatine; MPF, median palatal fossa; NFO, foramen in prenarial furrow; NVG, neurovascular grooves in prenarial furrow; PAL, palatine; RGR, rhinothecal groove.

mandible, that considerably overlaps the posterior half of the upper surface when the jaws are matched.

The upper edge of the rhinothecal groove extends to below the base of the maxillojugal contact, where it is about 35 mm wide. Immediately above the rhinothecal groove, the premaxillo-maxillary surface slants inwards at about 45° to vertical, continuing at this angle to meet an oblique sulcus that originates from the anterior margin of the external nares (Fig. 7B). This sulcus or prenarial furrow, (somewhat exaggerated by cracks) is the lowest of several, two or perhaps three, large tracts of fine grooves, predominantly representing the sensory branches of the maxillary nerve, that pass out of the external nares. The sulcus descends anteriorly to a tear-drop shaped (7 mm x 10 mm) aperture situated 42 mm above the tomial margin which appears to represent a large vascular foramen. The posterior surface of the beak is gently convex anterior to the nares, becoming flatter and very compressed dorsally. The external nares are holorhinal, oval openings about 18 mm by 30 mm. The cranial margin of the nares is directed posterolaterally in anticipation of the widening of the fronto-lachrymal facies.

The tip of the beak is slightly decurved in this species, as indicated by P907–28, a distal fragment retaining 42 mm of the ventral marginal profile, and P9464–108 which retains all but the tomial margin. Contours on this and the larger fragment suggest that although the mid to posterior dorsal surface of the beak is sharp and aquiline, the anterodorsal margin progressively widens, so that the tip appears rounded-off in palatal aspect. The dorsal outline of the beak appears to have been a smooth continuation of the arching profile of the culmen, as indicated by the beak fragment of *Dromornis stirtoni* (Fig. 15A, C). Unfortunately, the posterodorsal part of the culmen is broken off short of the frontal contact. A fragment (P87113–38) possibly representing the ethmofrontal contact is from a smaller individual or another species of dromornithid. The outer lamina of its extremely compressed lateral surfaces is broken above the narial aperture revealing the nasal septum. The posterior edge of the nasal septum bears a narrow ligmentous or membranous groove bordered by irregular crests. Dorsally, the groove expands into an oval, concave surface bordered by thin crests. Posteriorly, on either side of the septum, are deep grooves that probably represent the internal, dorsal margins of the nares. The outer lamina of the bone is broken just above the expansions of the prefrontal crests and narial margins.

Palate and quadrate. A left quadrate (P9464–100) retains all but the distal end of the orbital process and the lateral surface of the quadratojugal facet and external articular surface (Figs 8A–F, 9A,B). The body of the quadrate is broadly rectangular

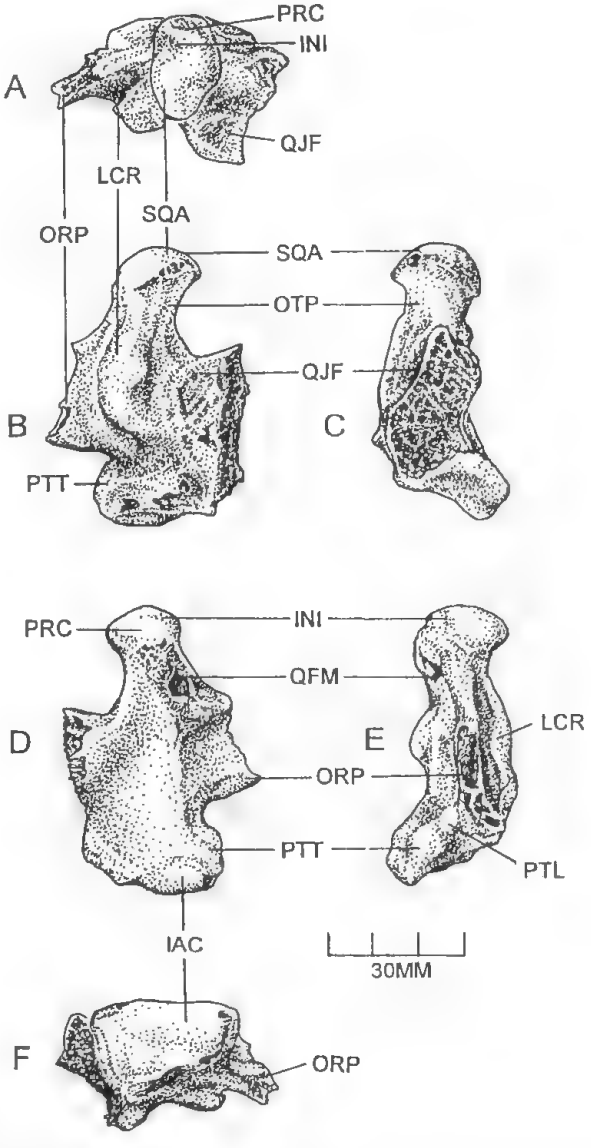


FIGURE 8. Left quadrate of *Bullockornis planei* (P9464–100); **A**, dorsal aspect; **B**, anterolateral aspect; **C**, posterolateral aspect; **D**, posterior aspect; **E**, anterior aspect; **F**, ventral aspect; note simple, rounded head of mobile (strepsostylic) quadrate. Abbreviations: IAC, internal articular condyle; INI, intercondylar incisure; LCR, lateral crest; ORP, orbital process; OTP, otic process; PTL, pterygo-quadrate ligament scar; PRC, pro-otic condyle; PTT, articular tubercle for pterygoid; QFM, quadrate foramen; QJF, articular facet for quadratojugal; SQA, squamosal articular surface or condyle.

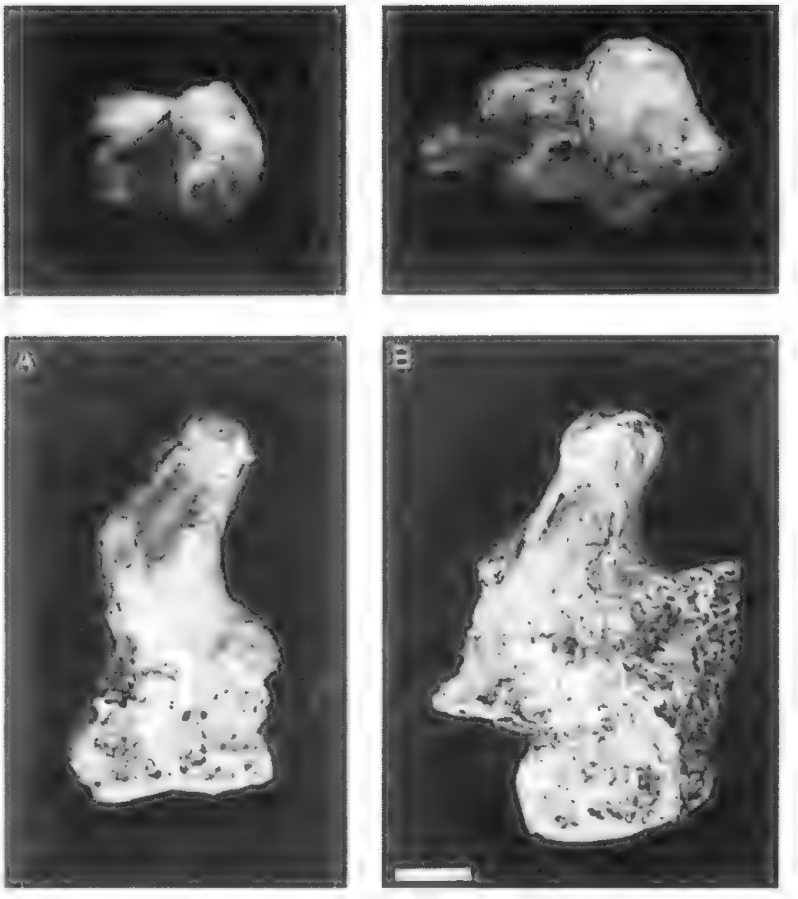


FIGURE 9. Photograph of left quadrates of *Bullockornis* spp., **A**, dorsal (above) and lateral (below) views of P9464–118; **B**, dorsal and lateral views of P9464–100; scale=1cm interval.

and about 15 mm thick. Its 60.0 mm long axis is curved posteriorly resulting in concave posterior and convex anterior surfaces. The otic process is stout and strongly buttressed mediolaterally by crests from bases of the orbital and quadratojugal processes. A single round, 4.0 mm diameter pneumatic foramen is present on the posterior surface 14 mm below the squamosal articular condyle or head. The broadly oval 19.0 mm x 15.0 mm head presents a smoothly rounded surface, the intercondylar incisure only faintly indicated. The pro-otic condyle is reduced to about 1/3 the size of the squamosal condyle and so weakly differentiated as to be easily dismissed.

A 25 mm long by 10 mm wide crest extends down the anteromedial side of the otic process, overhanging on its medial side, a deep ligamentous groove. The anterolateral surface of the crest represents the origin of the *m. adductor mandibularis externus profundus*. Posterolateral to the crest is a large, oval facet for the quadratojugal. Judging from the steep ascent of the dorsal margin of the facet, a well-developed posterior buttress was present. The base of the orbital process is about 25 mm deep and 5 mm thick. It appears to have been a broad, falcate flange. The posterior surface of the orbital process is shallowly concave. On its dorsoposterior margin, immediately below the quadrate foramen is a triangular ligament scar that corresponds to the posterior ligament of the quadrate, originating from a low tubercle on the posterointernal margin of the quadrate fossa. A low crest on the deeply concave posteroexternal margin of the otic process received the anterior cartilage of the meatal arch.

The anteromedial margin of the quadrate is notched between the base of the orbital process and the pterygoid tuberosity for a ligament and the dorsal process of the proximal pterygoid articular surface. The pterygoid tuberosity is an oval, 12 mm by 9 mm condylar process situated dorsomedial to the internal articular condyle. The internal articular condyle is elongated and narrow, 22 mm by 10 mm, separated from the largely missing lateral articular condyle by a flat, triangular surface. The corresponding lateral articular surface of the mandible indicates that the lateral condyle was broader than the medial.

Left quadrate P9464–118 is basically similar to P9464–100, though about 15% smaller, and

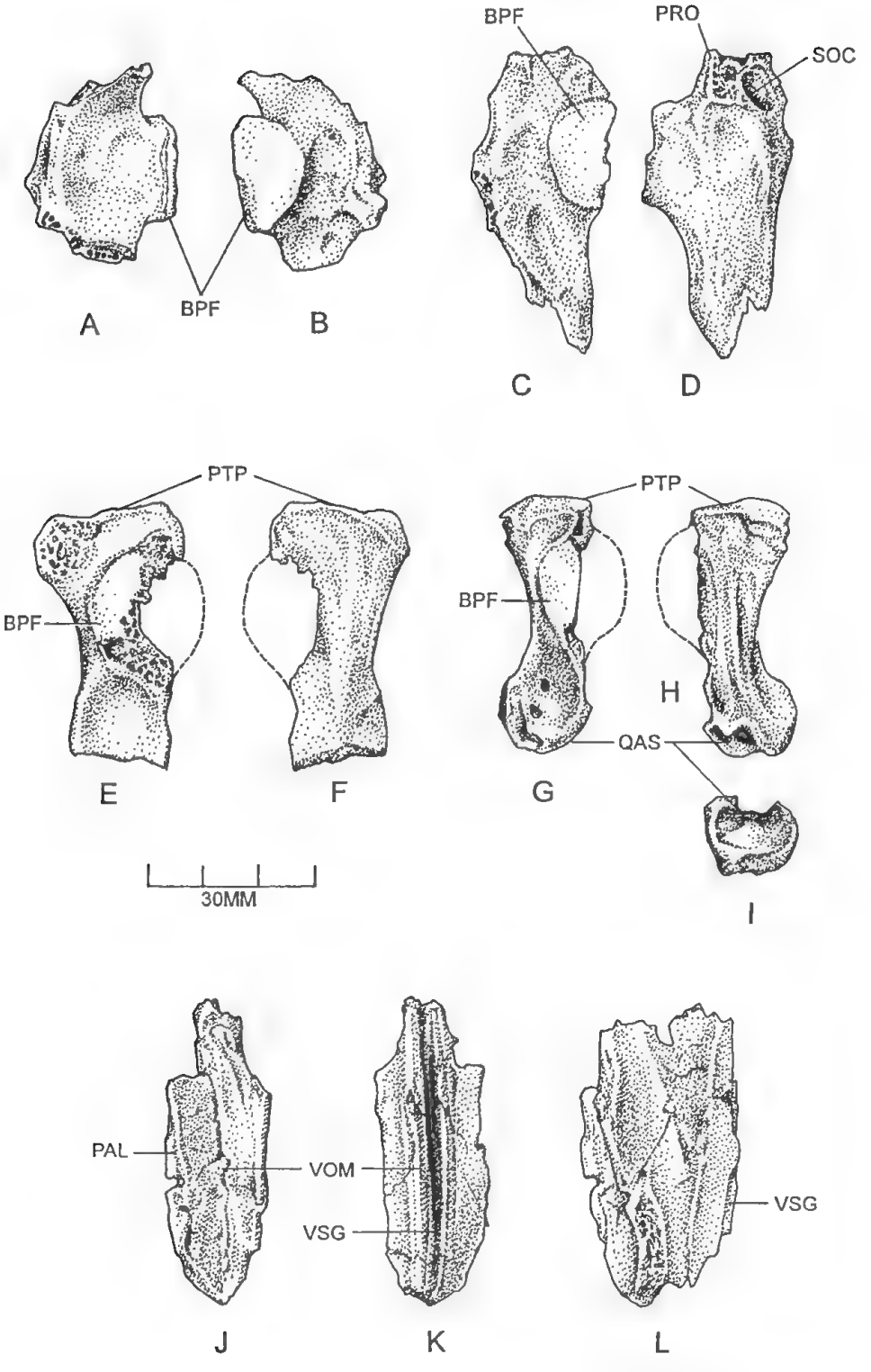


FIGURE 10. Palatal elements; **A** & **B**, ventral and dorsal views of right ?pterygoid fragment of *Bullockornis planei* (P9464–101); **C** & **D**, left dorsal and ventral views of left ?pterygoid fragment of *Bullockornis planei* (P87103–43); **E** & **F**, dorsal and ventral views of distal fragment of left pterygoid of *Dromornis stirtoni* (P98114); **G** & **H**, dorsal, ventral and proximal views of left pterygoid of *Ilbandornis sp.* (P98115) the joints are mobile, synovial and the fossa for the *mm. protractor + levator pterygoideus* is well-developed; **J–L**, ventral, dorsal and proximal views of vomeropalatine fragment of *Bullockornis planei* (P9464–108); the vomer forms a sliding joint on the parasphenoidal rostrum. Abbreviations: BPF, basipterygoid facet; PAL, palatine; PRO, ?base of palatine articular process; PTP, pterygoplatine articular surface; QAS, articular surface for quadrate; SOC, ?articular socket for palatine; VOM, vomer; VSG, vomeroseptal groove.

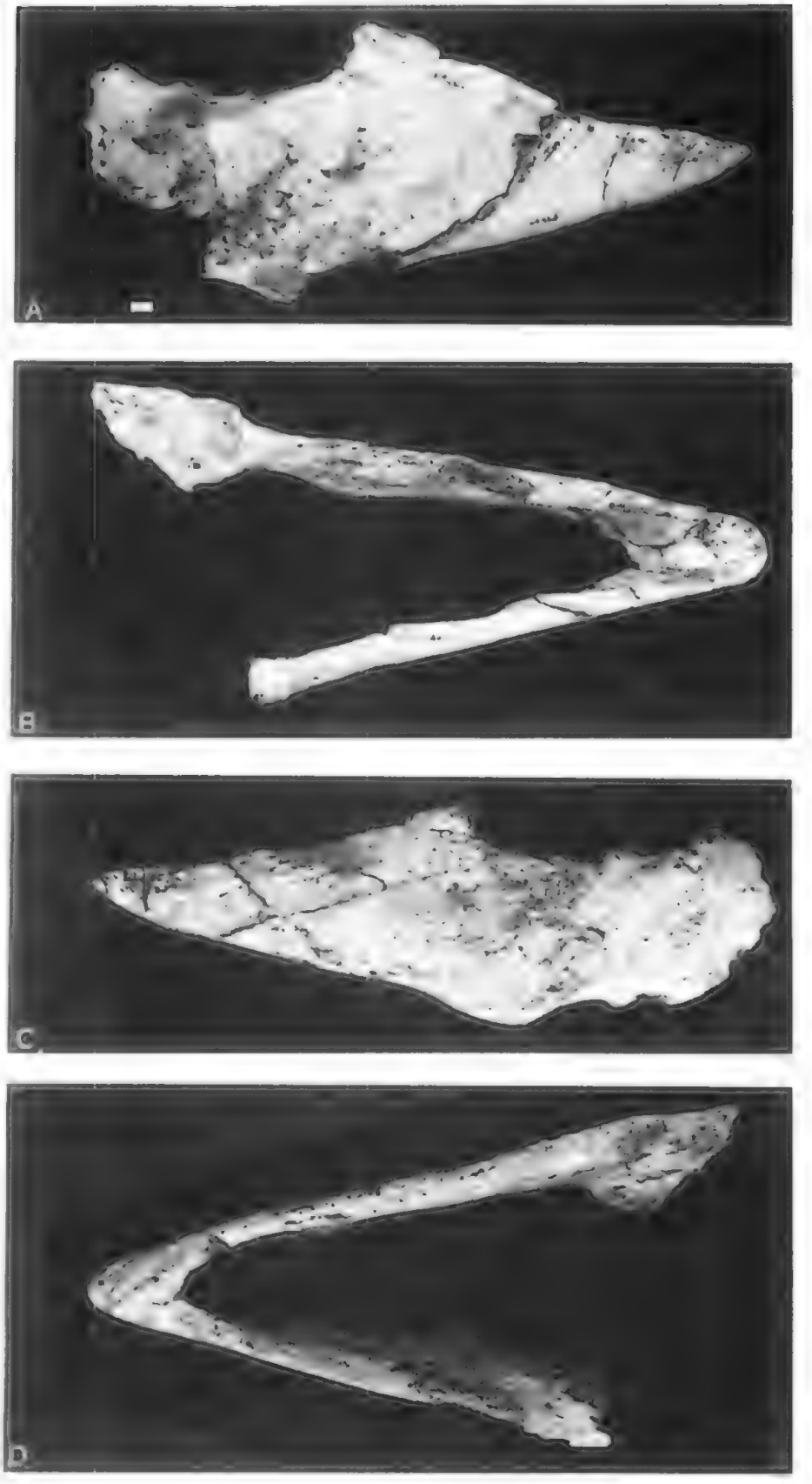


FIGURE 11. Photographs of partial mandible of *Bullockornis planei* (P9464–112); **A**, right lateral aspect; **B**, dorsal aspect; **C**, left lateral aspect; **D**, ventral aspect; scale=1cm interval.

differing in certain details sufficiently perhaps, to belong to one of the other species of *Bullockornis* (Fig. 9A). In this specimen, the intercondylar incisure is more distinct, though shallow and not sharply demarcated. The groove divides the curved, rectangular proximal articular surface into approximately equal parts, the pro-otic condyle being slightly shorter transversely than the squamosal condyle. The adductor process (lateral crest) is well-developed but less massive than in P9464–100 (Fig. 9A,B) and the dorsal crest of the orbital process extends further proximally to merge with the base of the pro-otic condyle.

Pterygoid?. Two fragments preserving little more than the basipterygoid articular facets may represent pterygoids of *Bullockornis* (Fig. 10A–D) The ventral surfaces are marked by a shallow fossa. Dorsally a wide sulcus commences lateral to the basipterygoid facet. A rugose crest extends along the lateral margin. The basipterygoid facets are flat, D-shaped surfaces, considerably off-set to the medial side of the distal end of the shaft. They are similar in size and shape in both specimens: P9464–101 is 20 mm by 14 mm and P87103–43 is 23 mm by 14 mm. P9464–101 preserves an oval 9 mm by 4 mm socket that may represent part of the palatine articular surface. The ventral process is broken off on both specimens. If these are correctly identified as pterygoids, they are relatively broader and thicker than the undoubted pterygoids of *Dromornis* and *Ilbandornis* (Fig. 10E–I) and differ in possessing a small socket joint with the palatine (Fig. 26A–I).

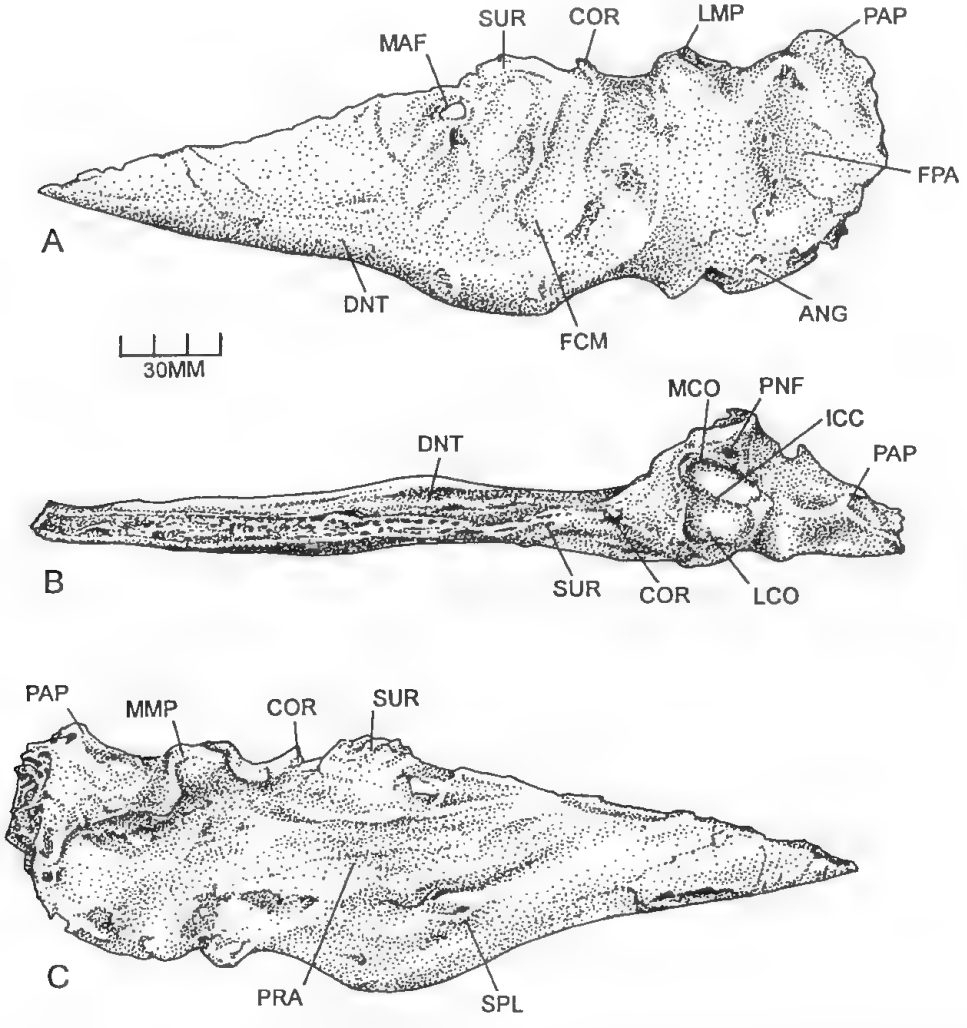


FIGURE 12. Mandible fragment of *Bullockornis planei* (posterior part of P9464–112); **A**, lateral aspect; **B**, dorsal aspect; **C**, internal aspect. Abbreviations: ANG, angular; COR, coronoid; DNT, dentary; FCM, fossa for external craniomandibular adductors; FPA, fossa for m. pterygoideus anterior; ICC, intercotylar crest; LCO, lateral cotyla; LMP, lateral mandibular process; MAF, mandibular fenestra; MCO, medial cotyla; MMP, medial mandibular process; PAP, postarticular (retroarticular) process; PNF, pneumatic foramen; PRA, prearticular; SPL, splenial; SUR, surangular.

Vomeropalatine?. The precise position and orientation of the bones represented by an isolated 56 mm long fragment (P9464–115) of fused palatal mid-line elements are unknown (Fig.10J–L). The fragment is triradiate in section with a median suture dividing a broadly U-shaped grooved surface, opposite of which is a deep longitudinal median crest bearing a narrow V-shaped slot. The external margins of the slotted crest are smooth and shallowly concave. The internal surfaces of the slot are also smooth and clearly indicative of a sliding joint. The median process probably represents the fused prevomers; its median slot articulating with the parasphenoid and the U-shaped sutured surfaces representing the hemipterygoid component of the palatines. A crest along the broken lateral margin probably represents the internal edge of the palatine. This interpretation seems in accord with the deep palatal structure of dromornithids in which the hemipterygoids and palatines might form the dorsoposterior margin of the internal nares similar to the equivalent region in parrots.

Mandible. Several large fragments of the mandible have been recovered, sufficient to fully reconstruct its overall shape (Figs 11A–D, 12A–C). The wedge-shaped dentaries are deep and flat-sided, with a slightly concave dorsal marginal profile, descending from posterior to anterior at an angle of about 30° relative to the ventral border. The surangular is a low, sinuous crest ascending towards the back of the deep posterior dentary margin at about 40°. The broad and robustly constructed articular is divided into lateral and medial cotylar surfaces by a low, but distinct intercotylar crest. Corresponding processes are present on either side (Fig. 12A–C). The internal mandibular process forms a C-shaped crest around the anteromedial margin of the articular groove, thickening posteriorly into a broad triangular tuberosity surmounted by a distinct facet. The pneumatic foramen is large. The external or lateral mandibular process is a prominent, rounded tuberosity. The long axis of the articular fossa is directed anteromedially and is slightly inclined posteriorly. The lateral cotyla is enclosed anterolaterally by a crest of the lateral mandibular process. The elongated, oval 29 mm by 15 mm medial cotyla is much deeper and considerably longer than the external one (21 mm x 17 mm).

The postarticular process is long and deep, terminating dorsally in an upturned conical eminence. A considerable part of the postarticular process is missing from the illustrated specimen. The internal surface is deeply notched to accommodate the large post-tympanic crests and neurocranio-mandibular process. The coronoids are small but distinct projections arising from a low lateral crest. The surangular forms a low sinuous crest, at the base of which is a small mandibular fenestra. The angular suture is visible on P9464–112, trending horizontally about 40 mm above the inferior border. The prearticular forms a shelf-like horizontal crest extending along the base of the surangular. The ventral profile of the mandible is deeply notched immediately posterior to the dentary-splenial articulation resulting in a

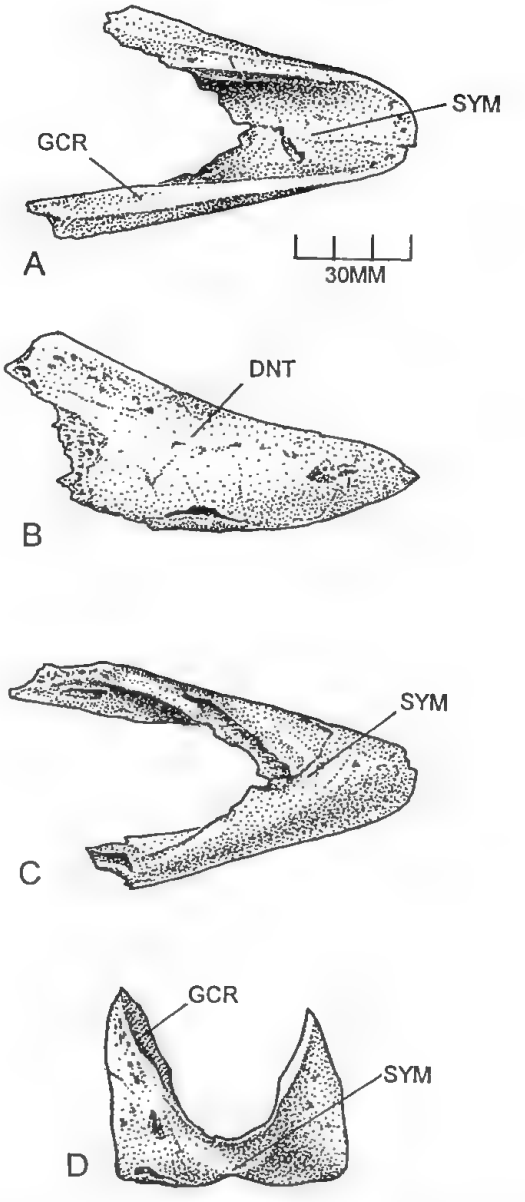


FIGURE 13. Dentary fragment of *Bullockornis planei* (P9464–113) showing form of the tip; **A**, dorsal aspect; **B**, lateral aspect; **C**, ventral aspect; **D**, anterior aspect. Abbreviations: DNT, dentary; GCR, gnathothecal crest; SYM, symphysis.

large, rounded gonial eminence. The splenial border is thick and rounded.

The dentary symphysis is fused, forming a U-shaped, scoop-like termination (Figs 11B–D, 13A–D). The ventral surfaces of the anterior portions of the mandibular rami are smooth, with no indication of an anteroposterior groove. Externally, the bases of the rami turn abruptly upwards from the ventral surface of the symphysis lending a decidedly slab-sided appearance to the region. The rami extend posteriorly in a long, narrow parabola, the longitudinal axis of each ramus being nearly straight. A thick internal gnathothecal crest commences about 40 mm posterior to the anterior margin of the tip. The profile of the tip is convex, corresponding to the concave, overhanging profile of the margin of the tip of the upper beak. In overall form, each hemimandible is deep, robustly constructed and scimitar-like. The external adductor muscle scar forms a deep circular fossa extending down to the inferior border and for an equivalent distance anteroposteriorly. Three distinct muscular ridges are present within the fossa reflecting considerable muscular differentiation of the craniomandibular adductors.

?*Bullockornis* sp.

Referred material: Occipitals, P87103–44, P8695–273, P8765–1, P9464–109.

Locality: Bullock Creek, Northern Territory (additional data as for *Bullockornis planei*).

Lithic unit and age: Camfield Beds; middle Miocene.

Fauna: Bullock Creek Local Fauna.

Description:

Occipital. Four occipital fragments represent a smaller dromornithid, presumably belonging to the unnamed Bullock Creek LF species described by Rich (1979) as ?*Bullockornis* sp. These are distinguished from the same region of the cranium of *Bullockornis planei* by their much smaller size and transversely broader occipital condyle with a more flattend dorsal margin. A circular fossa situated ventral to the base of the occipital condyle is a distinctive feature. The paroccipital processes are weakly developed and project ventrally rather than posteriorly. The basioccipital is flatter and broader than in *Bullockornis planei*. The occipital region of this species closely resembles specimens assigned to the two known species of the Alcoota LF genus *Ilbandornis*.

Genus ***Dromornis*** Owen 1872

Dromornis stirtoni Rich 1979

Referred material: Cranial bases missing basitemporal plate and basipterygoid processes P98105, P9342; occipitals P98106, P98111; upper beak, P9245; mandibles, P98107, P98112; left pterygoid, P98114.

Locality: Alcoota Homestead, Northern Territory, Australia.

Lithic unit and age: Waite Formation; late Miocene.

Fauna: Alcoota Local Fauna.

Description:

Cranium. The largest of the cranial fragments, P98105, slightly exceeds that of *Bullockornis planei* (P9464–106) in overall size (Fig. 14A–B). P9342 is approximately the same size as the latter specimen. Allowing for individual variability, what is known of the cranial morphology of *Dromornis stirtoni* appears to be very similar to that of *Bullockornis planei*. Both *Dromornis stirtoni* specimens are coronal sections preserving the backs of the orbits, fronto-rostral joint, margins of the basipterygoid and anterior surfaces of the opisthotics. The posterior surfaces are sheared off at about the level of the parietals. The occipital condyle of P98105 was impacted into the posterior surface. As in *Bullockornis planei* the orbital plates are shallow, with large marginal foramina. The postorbital processes of P98105 are longer and narrower than in any *Bullockornis planei* specimen, but those of P9342 are very similar (i.e. short and broad) to the largest Bullock Creek species.

Rostrum. The upper beak of *Dromornis stirtoni* (P9245) is represented by a 200 mm long by 140 mm deep and 60 mm wide fragment that preserves the profile of the beak and its basic form up to an unknown distance anterior to the external nares (Fig. 15A–C). As in *Bullockornis*, the beak

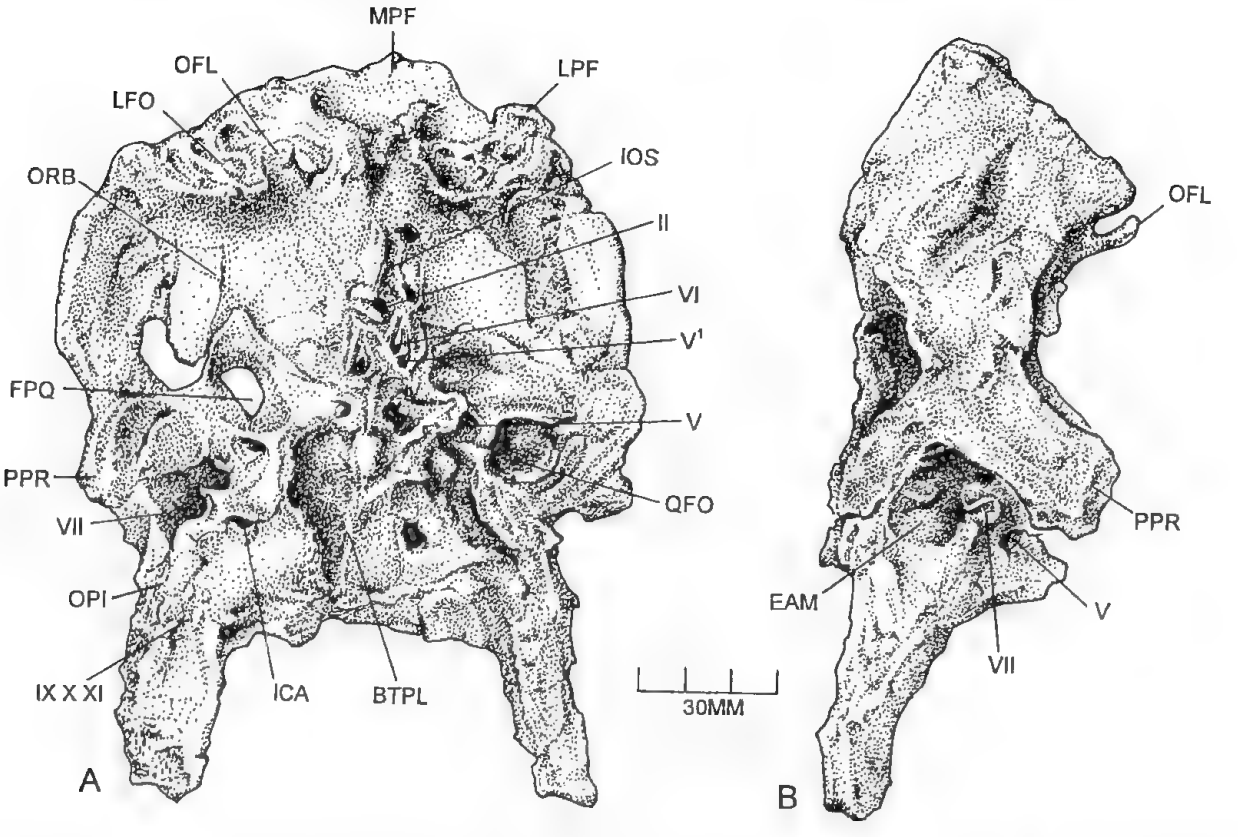


FIGURE 14. Fragmentary cranium of *Dromornis stirtoni* (P98105); **A**, anterior aspect; **B**, lateral aspect. Abbreviations: BTPL, basipterygoid plate (basipterygoid+basioccipital); EAM, external auditory meatus; FPQ, fossa for *mm. protractor quadratus+pterygoideus*; ICA, foramen for internal carotid artery; II, optic nerve foramen; IOS, interorbital septum; IX X XI, accessory, vagus and glossopharyngeal nerve; LFO, lateral fossa or sinus of the frontal; LPF, lateral processof the frontal; MPF, median process of the frontal; OFL, orbital flange; OPI, opisthotic; ORB, orbit; PPR, postorbital process; QFO, quadrate fossa; V, trigeminal nerve; V^1, ophthalmic nerve; VI, abducens nerve; VII, facial nerve.

is deep, narrow and aquiline, with a slightly hooked tip. In ventral aspect, the palate is elongated and narrow with a shallow, solid surface. The median palatal fossa is expressed as a distinct oval depression in the posterior end of the fragment. Posteriorly, the maxillopalatines are fused and form a median process, on either side of which are deep notches possibly representing the anterior borders of the internal nares. The palatines are broad distally, though apparently not as expanded in this region as in *Bullockornis*. Rhinothecal grooves, similar to those of *Bullockornis planei* are evident, though poorly preserved on the specimen.

Pterygoid. The distal half of a left pterygoid (P98114) preserves part of the basipterygoid facet and a nearly complete palatine articular condyle (Fig. 10E,F). The shaft is relatively more slender and triangular in section than that of *Bullockornis*. The basipterygoid facets are situated at the distal end of the shaft and, though the medial half of the facet is missing, it is evident that they were offset to the medial side. These were oval, 29 mm long by an estimated 18 mm wide with a flat surface. The palatine articular surface is 28 mm long by 12 mm wide. A triangular break on the dorsolateral surface may have represented a small process. The preserved surface indicates a simple transverse condylar joint, unfused to the palatine, but with limited movement. A deep, oval fossa for the *m. protractor pterygoideus* is present on the dorsal surface proximal to the basipterygoid facet. The proximal (quadrate) articular surface missing. Based on the complete pterygoid of *Ilbandornis*, the *Dromornis* pterygoid was probably 60–65 mm long.

Mandible. The mandibles of *Dromornis stirtoni* are up to 460 mm long and 140 mm deep at the surangular apex (Figs. 16A–C, 17, 18A,B). In addition to their slightly larger size, the mandibles

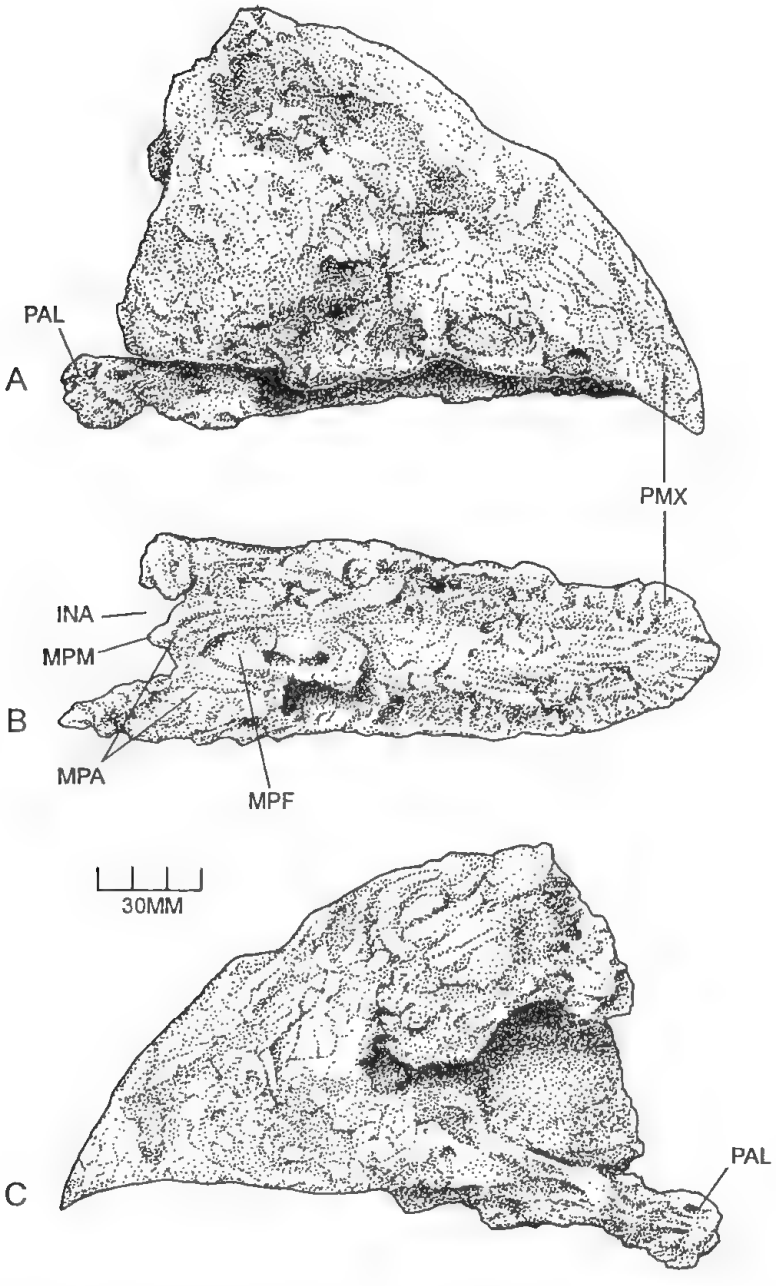


FIGURE 15. Upper beak fragment of *Dromornis stirtoni* (P9245); **A**, right lateral aspect; **B**, palatal aspect; **C**, left lateral aspect. Abbreviations: INA, internal nares; MPA, maxillopalatine; MPF, median palatal fossa; MPM, median palatal process; PAL, palatine; PMX, premaxilla;

differ from those of *Bullockornis planei* in other minor respects. While the mandibles of *Dromornis* are generally very similar to those of *Bullockornis planei*, they are slightly deeper relative to their length, more gracile and appear to have a transversely thinner postarticular process. There is no indication of the coronoid on any specimen and the gonial eminence is broader and less pronounced. Also apparent is a more rounded than angular turn of the dentary at ventral margin of the symphysis. As in *Bullockornis*, the symphysis is fused, but appears to have been shorter. Several *Bullockornis* fragments are not inferior in size to the largest specimens of *Dromornis stirtoni*. The description of the *Bullockornis* mandibles otherwise applies to those of *Dromornis*.

P98107 (Fig. 17) is the only dromornithid mandible in which any part the retroarticular salient is preserved. Judging from the shape of the

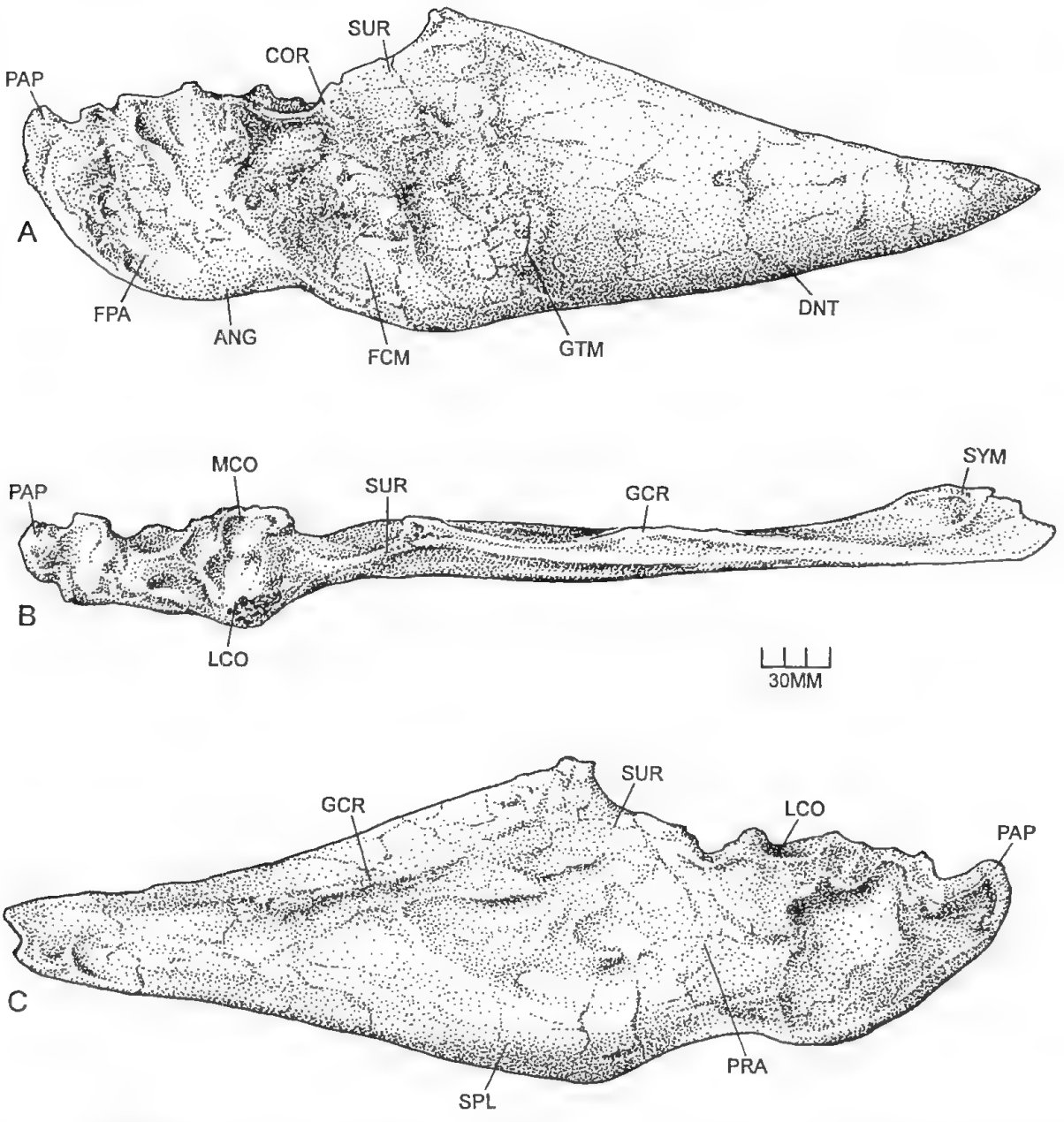


FIGURE 16. Right hemimandible of *Dromornis stirtoni* (P98107) **A**, lateral aspect; **B** dorsal aspect; **C**, internal aspect. Abbreviations: ANG, angular; COR, coronoid; DNT, dentary; FCM, fossa for external adductors; FPA, fossa for *m. pterygoideus* anterior; GCR, gnathothecal crest; GTM, posterior gnathothecal margin; ICC, intercotylar crest; LCO, lateral cotyla; MCO, medial cotyla; PAP, postarticular; PRA, prearticular; SPL, splenial; SUR, surangular; SYM, symphysis.

FIGURE 17. Photograph of right hemimandible of *Dromornis stirtoni* (P98107) scale interval=1cm.

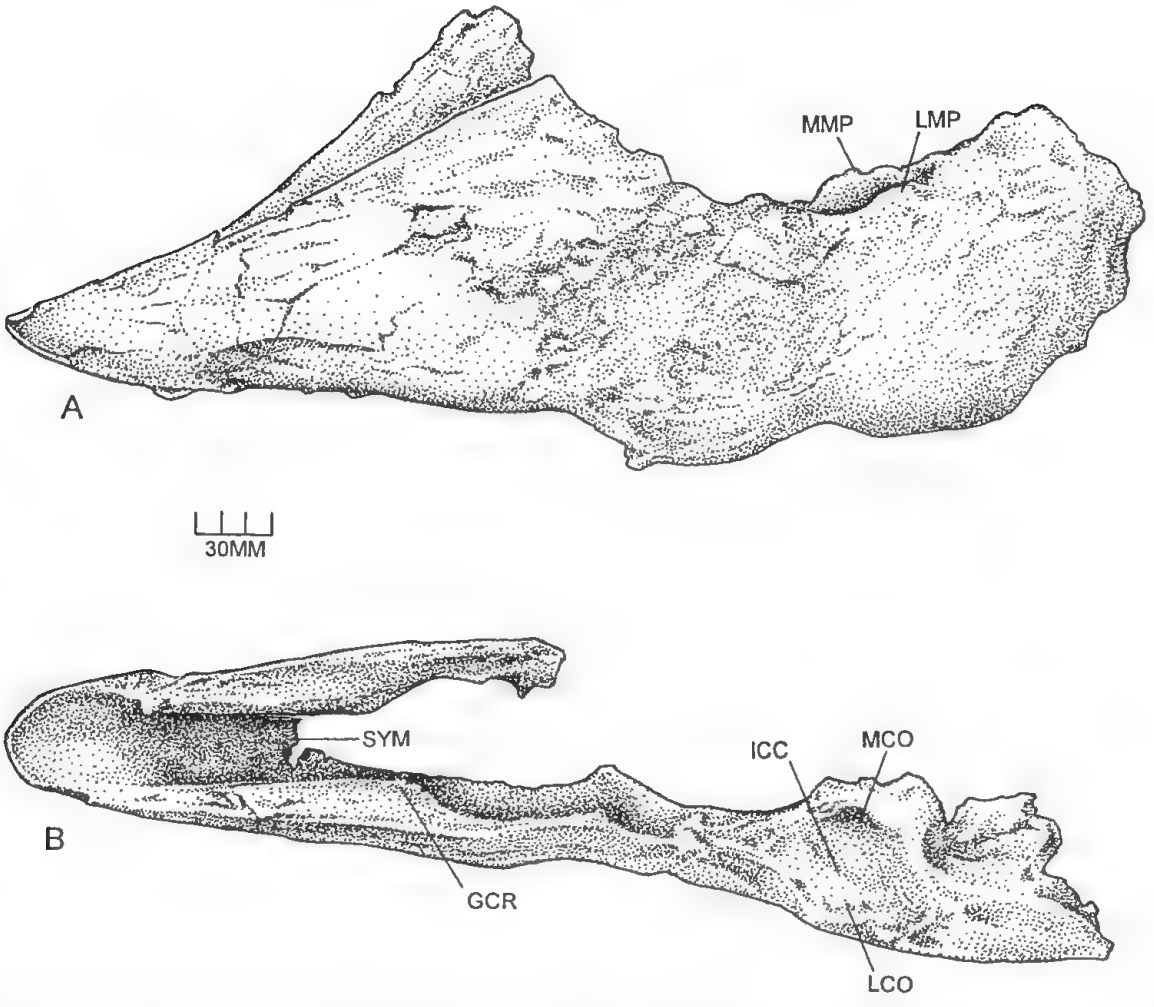


FIGURE 18. Fused hemimandibles of *Dromornis stirtoni* (P98112) **A**, lateral aspect; **B**, dorsal aspect. Abbreviations: GCR, gnathothecal crest; ICC, intercotylar crest; LCO, lateral cotyla; LMP, lateral mandibular process; MCO, medial cotyla; MMP, medial mandibular process; SYM, symphysis.

break, at least half of the distal end (~20 mm) is missing. Projected outlines indicate a crescent-shape structure with the pointed tip, recurved and directed dorsally or slightly anterodorsally. Though mediolaterally compressed (~10–12 mm thick in mid-region), the retromandibular process is very deep dorsoventrally, and rather than being a simple blade-like structure, the internal surface of the entire eminence is emarginated by low crests. As in *Bullockornis*, a shallow fossa is present in the area of the conical recess, as the inferior buttress or crest of the medial mandibular process is comparatively weak.

Genus *Ilbandornis* Rich 1979

Ilbandornis spp.

Referred material: Fragment of cranium, P9843; occipitals, P98108, mandibles, P98109, P98111; left quadrate fragment, P98116; left pterygoid, P98115.

Locality: Alcoota Homestead, Northern Territory, Australia.

Lithic unit and age: Waite Formation, late Miocene.

Fauna: Alcoota Local Fauna.

Description:

Cranium. The cranium of *Ilbandornis* sp. is 30–40% larger than the equivalent part of an Ostrich (Figs 19A–C, 21A). While comparable parts of the cranium are very similar to *Bullockornis* and *Dromornis*, the occipital condyle is relatively small: 11.5 deep by 13.5 wide and distinctly

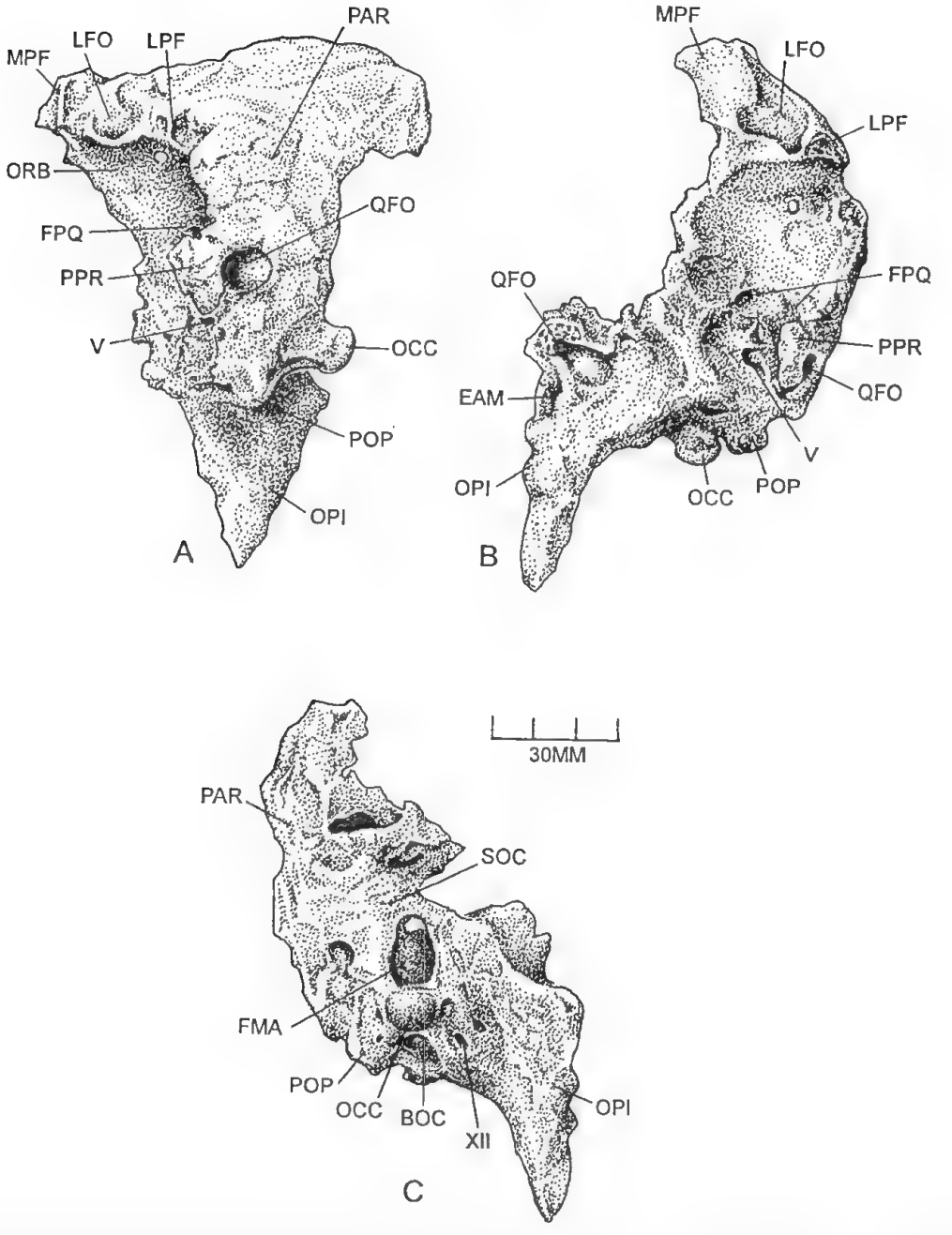


FIGURE 19. Cranial fragment of *Ilbandornis* sp. (P9843) **A**, lateral aspect; **B**, anterior aspect; **C**, posterior aspect. Abbreviations: BOC, basioccipital; EAM, external auditory meatus; FMA, foramen magnum; FPQ, fossa for *m. protractor quadratus+pterygoideus*; LFO, lateral fossa or sinus of frontal; LPF, lateral process of frontal; MPF, median process of frontal; OCC, occipital condyle; OPI, opisthotic; ORB, orbit; PAR, parietal; POP, paroccipital process; PPR, postorbital process; QFO; quadrate fossa; SOC, supraoccipital; V, trigeminal nerve foramen; XII, hypoglossal nerve foramen (condylar).

flattened dorsally. A circular pit is present anteroventral to the base of the occipital condyle. The foramen magnum is oval (19.0 mm x 11.5 mm). The back of the cranium was about 87 mm wide across the post-tympanic crests at the level of the occipital condyle and approximately 145 mm high from the tip of the opisthotic to the top of the cranium. The orbit, as in other species of dromornithid, is shallow and C-shaped, terminating anterodorsally in a low frontal tuberosity. Medial to the tuberosity is the characteristic lateral fossa. The cranial surface above the orbit and the ethmofrontal area is relatively deeper than in other species of dromornithid. The opisthotics are wide, ventrally elongated and greatly expanded posteriorly into a

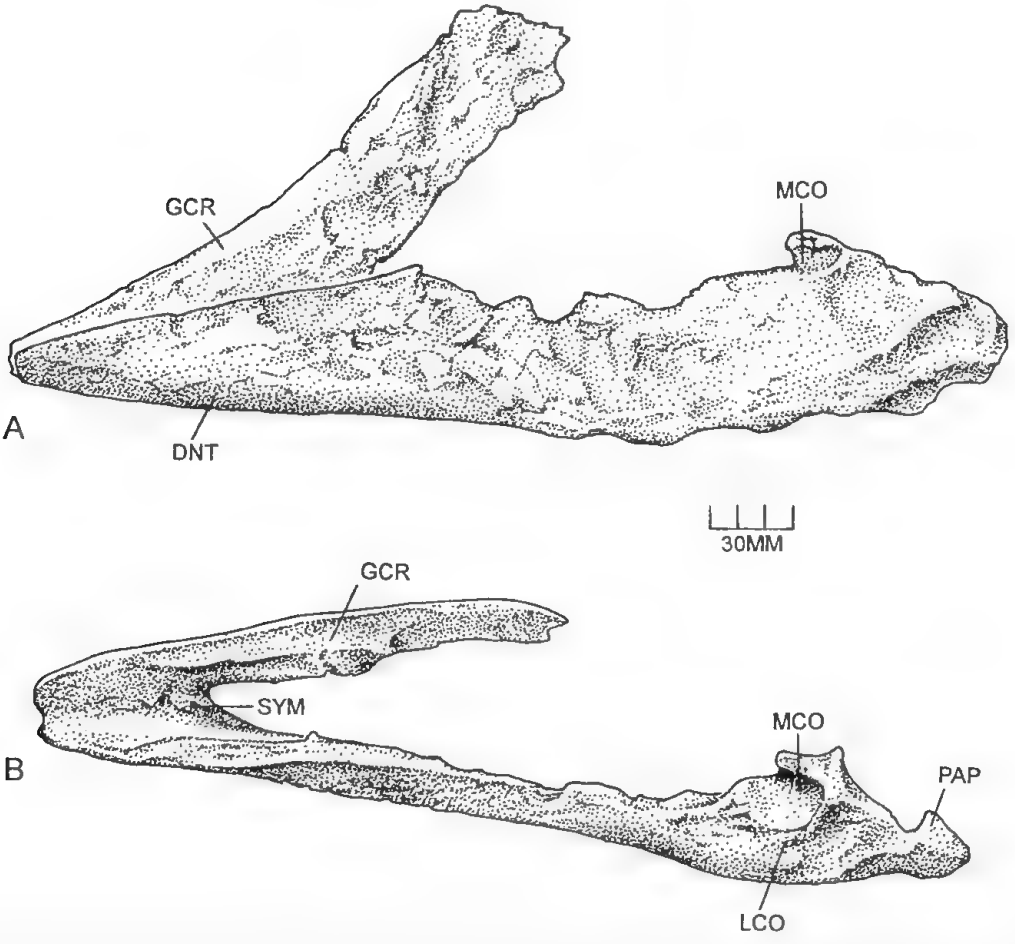


FIGURE 20. Fused hemimandibles of *Ilbandornis* sp. (P98109); **A**, lateral aspect; **B**, dorsal aspect. Abbreviations: DNT, dentary; GCR, gnathothecal crest; LCO, lateral cotyla; MCO, medial cotyla; PAP, postarticular; SYM, symphysis.

sharp, wing-like post-tympanic crests. The neurocranio-mandibular process is laterally compressed and pointed. The quadrate fossae are oval sockets, about 10 mm by 12 mm. The postorbital process is about 20 mm long and 12 mm wide. The basitemporal plate is a pyramidal elevation broken immediately below the parasphenoidal rostrum. The shape of the upper beak is unknown for this species.

Quadrate. A proximal fragment of a left quadrate (P98116), about 15% smaller, but similar to that of *Bullockornis*, probably represents one of the two *Ilbandornis* species. The proximal articular surface of this quadrate specimen is broader and more rectangular than oval in dorsal aspect. There is a faint intercondylar incisure and the pro-otic condyle is slightly broader than the squamosal condyle. The posterointernal surface is damaged in the area of the foramen. An anterolateral crest is present, which appears to have been shorter, though as prominent as in *Bullockornis*. In the *Ilbandornis* specimen, an oval fossa is present in about the same position as the ligamentous groove along the margin of the lateral crest in *Bullockornis*. The orbital process is incomplete.

Pterygoid. The pterygoid (P98115) is fairly short (51.5 mm) and straight, retaining a simple, 17.5 mm by 12.5 mm transverse condylar joint with the palatine distally and a deep, oval (11 mm x 8 mm) articular socket for the quadrate proximally (Fig. 10G–I). The 20 mm by (estimated) 15 mm basipterygoid facet is incomplete, but appears to have been oval and flat. As in other dromornithids, the facets are situated near the distal end and offset to the dorsomedial side of the shaft. A deep fossa for the *m. protractor pterygoideus* is present on the posteroventral surface which is penetrated by two small foramina. Dorsally, a low, longitudinal crest extended over most of the length of the shaft. Much of the ventromedial surface is eroded, which includes the ventral crest, the ventral half of the

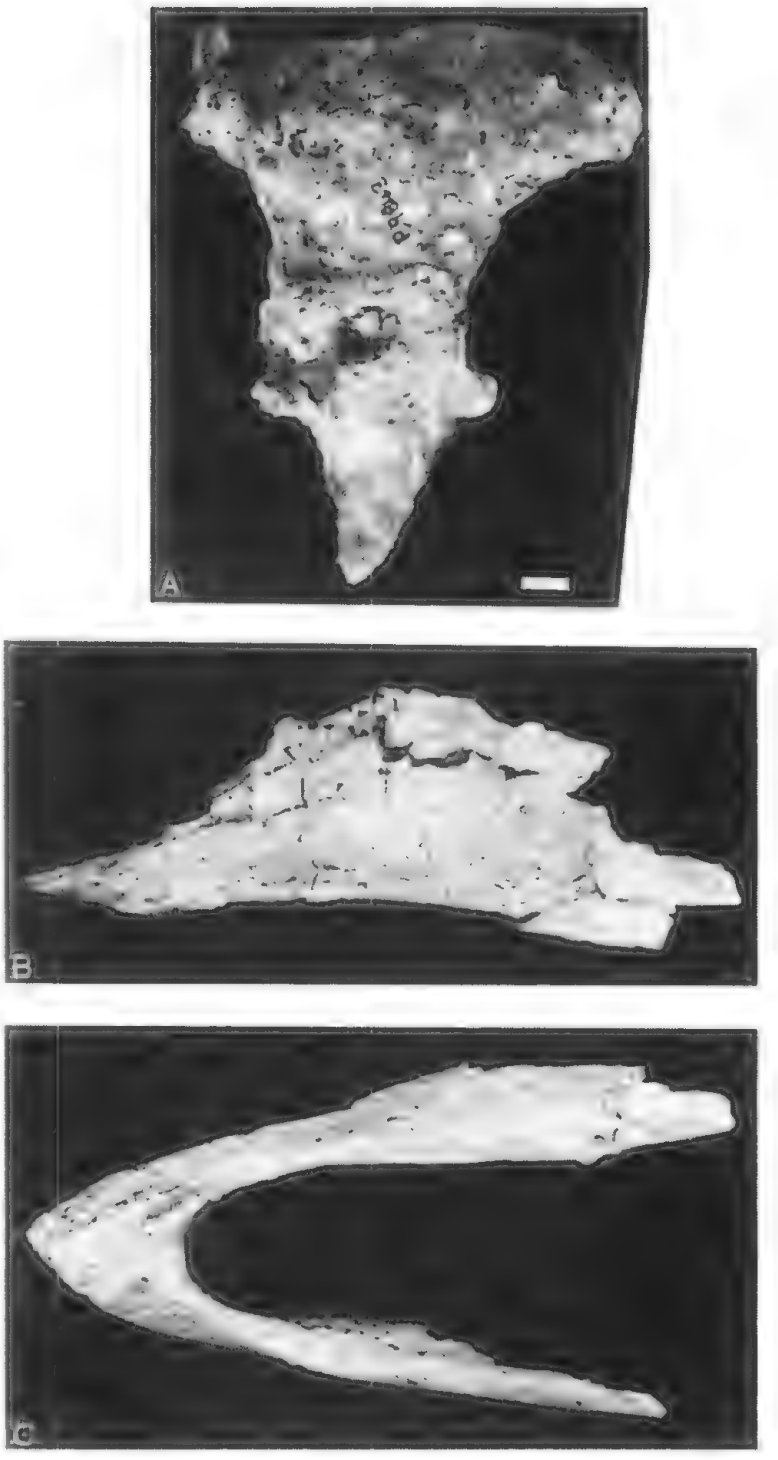


FIGURE 21. Photographs of: **A**, left side of cranial fragment of *Ilbandornis* sp. (P9843) note laterally compressed, dagger-like neurocranio-mandibular process; **B**, left side of mandible fragment of *Ilbandornis* sp. (P98111), distinguished from mandible P98109 by concave ventral border, small size, deeper dentary, wide symphysial notch, **C**, ventral aspect of mandible fragment of *Ilbandornis* sp. (P98111).

basipterygoid facet and the ventromedial process of the pterygopalatine articular surface.

Mandible. The most complete mandible of *Ilbandornis* is shallower in relation to its length than in *Bullockornis* and *Dromornis*, though otherwise similarly constructed. P98109 is 380 mm long and about 70 mm deep at the distal end of the dentary margin. The tomial profile is slightly concave; decurved at the tip (Fig. 20A,B). The ventral margin is straight. As in other dromornithid species, the symphysis of the two

hemimandibles is fused. The most obvious differentiating features of this specimen is the suppression of its gonial angle and slenderness of the horizontal rami.

A second, much smaller specimen of *Ilbandornis* (P98111) is distinguished by its concave ventral profile commencing anterior to the gonial expansion (Fig. 21B–C). A section of the tomial margin is present, the angle of which suggests that the mandible was significantly deeper relative to its length than P98109. As indicated by the postcranial skeleton, the two species of *Ilbandornis* are quite different, but to which species the mandibles or the cranial fragment might belong has not been confirmed by association.

Observations on *Genyornis*

Though the skull of *Genyornis newtoni* is poorly preserved, it makes an important contribution to dromornithid morphology in showing proportions that must otherwise be inferred from isolated and fragmentary elements. Conversely, the new dromornithid material elucidates some structural elements of *Genyornis* previously overlooked or considered too fragmentary to interpret. As the actual skull of *Genyornis newtoni* was unavailable for study[1], we have relied on the photographic plates and descriptions of Stirling and Zietz (1913).

The preserved neurocranial and orbital elements closely resemble those of better preserved dromornithid specimens (Stirling and Zietz 1913 pl. XXXVI, Fig. 1). Of particular interest are the relationships at the cranio-rostral contact. While this area is partially obscured by plaster, *Genyornis* appears to have a well-developed transverse cranio-rostral joint indicated by a shallow V-shaped notch in the dorsal profile. The culmen is strongly arched as in *Bullockornis*, except that the anterior limb of the arch descends steeply towards the tip of the beak.

The descending process of the lachrymal is probably indicated by a raised area of oriented fragments. The dorsal part of the lachrymal extends a lobe anteriorly defining the posterior side of the anteorbital fenestra. The anteorbital fenestra appears to have been a triangular slot, anterior to which, a fan-shaped mass descends obliquely towards the ventral margin, representing the anteroinferior process of the nasal bone. A hollow region immediately anterior to the descending process of the nasal suggests a large, oval external narial aperture. The posterior margin of the maxilla is partially intact. It appears to have been deep, and obviously made contact with the anterior process of the nasal bone.

The back of the cranium is badly damaged, the only visible structure being the quadrate fossa, the right post-tympanic crest having been crushed forward, obscuring the auditory meatus. Stirling and Zietz (1913) placed the quadratojugal in the position shown in the photograph. An oval structure lying under the quadratojugal could be an articular facet of the basipterygoid process which would occur in about that position. Having examined the photograph carefully under magnification, it clearly represents bone, with some open trabeculae around the anterior edge. This appears to be the structure Stirling and Zietz (1913) refer to as '...part of the articular surface for the quadrate...'. Stirling and Zietz were convinced that extreme lateral crushing of the specimen had distorted the proportions of the beak beyond usefulness, but as it is now known that the beak in dromornithids is laterally compressed, the shape is probably fairly representative for the species.

Assuming that the fossil retains a reasonably accurate indication of the original shape of the skull, *Genyornis newtoni* seems to bear a closer superficial resemblance to a goose (*Anser*) or a screamer (*Chauna*) than it does to any ratite species. Overall proportions are goose-like: in the goose, orbital length is 21% of the total length, which is 17% in *Genyornis*. The beak is 50% of the cranial length in the goose, as it is in *Genyornis*, and the depth of the cranium in the goose is about a third of its length, the same, as near as we can estimate, as in *Genyornis*. In addition to its *Anser*-like proportions, the outline of the beak and dorsal surface of the cranium of *Genyornis* are strongly reminiscent of a screamer, such as *Chauna torquata* (Anhimidae); the culmen being aquiline and the inferior margin of the mandible being slightly concave. The reconstruction of the skull of *Genyornis* in Rich

[1] Neville Pledge, Curator of Fossils, South Australian Museum informed us that the skull of *Genyornis newtoni* is '...too fragile in its present state to travel,' adding: 'When it was found originally, exposed in the surface weathering zone, apparently it was recognised as a skull but too fragmentary to collect in the rather primitive way the diprotodons were being dug up. Instead they (whoever they were) poured liquid plaster over the surface, embedding the bone fragments where they were. Enough must have percolated through to the bottom to hold the unexposed side in place when the block was excavated and turned over. I do not believe any reconstruction was done to the shape or proportions of the skull by Stirling and Zietz.'

(1979, Fig. 1) is based on emu morphology, at the time a reasonable but misleading assumption, showing a large confluent anteorbital-narial aperture with horizontal premaxillary and maxillary plates, emu-like prefrontal and postorbital with a well-defined temporal fossa bounded by postorbital and zygomatic processes.

Stirling and Zietz (1913) concluded that the quadrate of *Genyornis newtoni* '...differs very considerably from that of existing ratite birds...', though in spite of this explicit observation to the contrary, Matthew and Granger (1917) state that the quadrate of *Genyornis* '...is typically dromaeognathine'. While Stirling and Zietz's (1913) figures of the quadrate generally correspond to that of *Bullockornis planei*, there are some significant proportional differences. The quadrate of *Genyornis* is less robust, with a narrower body and much narrower condyles for the articular.

The articular facet for the qudratojugal is situated lower relative to the external articular condyle than in *Bullockornis* but 'sessile' rather than stalk-like as in ratites. Unlike *Bullockornis*, the head is small and composed of a single, undivided hemispherical surface (Stirling and Zietz 1913). A strong crest extends down the anterolateral surface of the otic process for the *m. adductor mandibularis externus* and the pterygoid articulation is a small oval tuberosity, unlike the large, concave, elongated pterygoid facets in the Emu and Ostrich.

Stirling and Zietz (1913) apparently confined their comparison of *Genyornis*'s quadrate to ratites alone, for had they examined the quadrates of a domestic chicken, megapode or duck, surely the more familiar ground would have been recognised. Stirling and Zietz (1913) isolated the very suite of characters that indicate that the quadrates of *Genyornis* were mobile, like those of neognathous birds, but failed to appreciate the significance of the morphological complex in relation to dromornithid systematics.

Comparative morphology

The long systematic association of dromornithids with ratite birds necessitates a

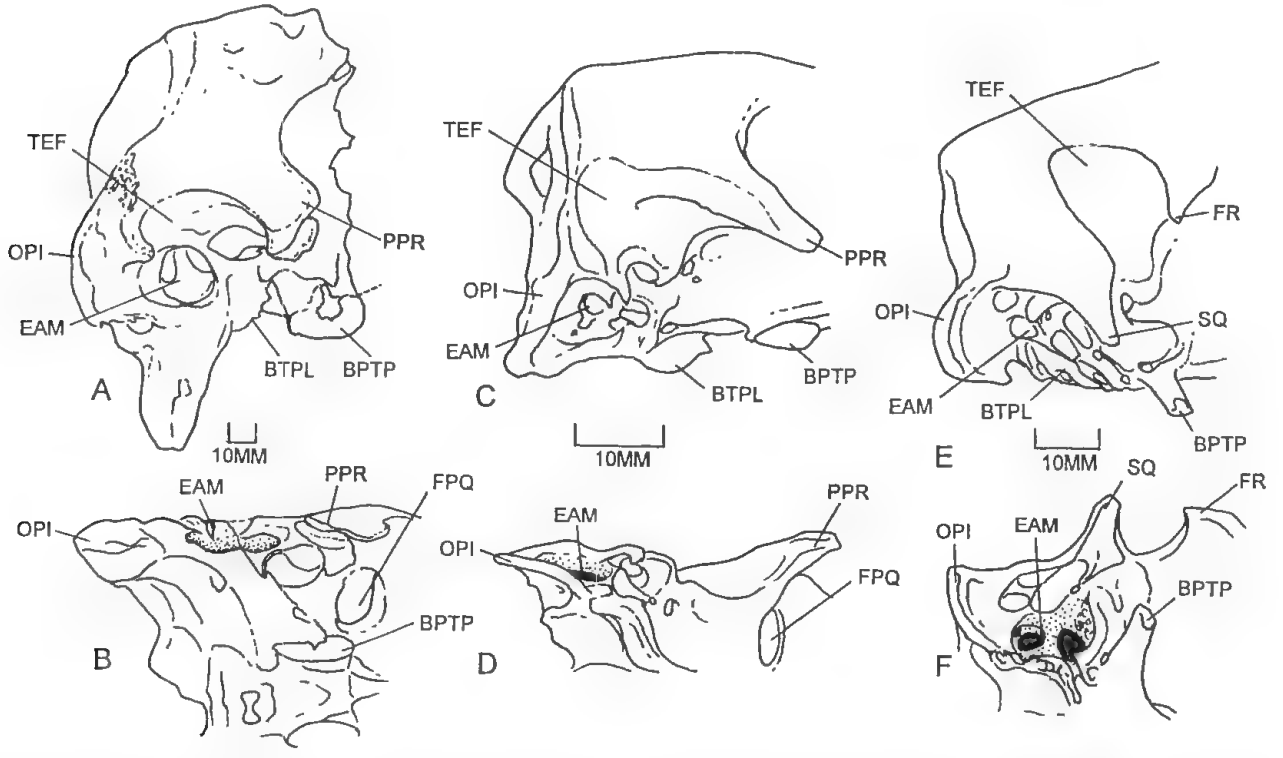


FIGURE 22. Comparison of the form of the temporal fossa, postorbital and zygomatic process, opisthotic and external auditory meatus in **A** & **B**, *Bullockornis planei*; **C** & **D**, *Anas* sp. (domestic duck); **E** & **F**, *Dromaius novaehollandiae* (Emu). In the Emu, squamosal (SQ)=zygomatic process and frontal (FR)=postorbital process; BPTP, basipterygoid process; BTPL, basipterygoid plate; EAM, external auditory meatus; FPQ, fossa for *m. protractor et levator quadratus+pterygoideus*; FR, frontal; OPI, opisthotic; PPR, postorbital process; SQ, squamosal; TEF, temporal fossa.

comparison with the dromaeognathous species. While examples from a variety of living neognathous orders were examined, the majority of our observations pertain to anseriform and galliform species. The Ostrich and Emu are the principle palaeognathous forms used for comparison. Dromornithid features of particular interest in this study are the form and structural relations of the cranial vault; the cranio-rostral surfaces; the zygomatic process and temporal fossa; the basipterygoid-parasphenoid complex; the quadrate and pterygoid and the upper beak.

Cranium. The dermal elements of the dromornithid cranium are exceptionally short, compared to galliform and ratite birds. The frontal is retracted and broad, somewhat like that of a parrot. The narrow crescents of the parietals appear to be mostly confined to the posterior surface of the cranium, extending a short distance onto the lateral surface above the squamosal at the level of the quadrate fossa. In the Emu, Ostrich and Rhea, the parietals are broad and extend to the laterosphenoid below the postorbital process of the frontal. An interparietal-like structure is outlined above the supraoccipital in *Bullockornis*. Heilmann (1926) depicted an interparietal in the gosling, but we were unable to confirm its presence in a younger domestic gosling specimen. It appears to be present in a young Magpie goose, although the suture could represent an overlap of the parietal onto the supraoccipital. A distinct interparietal bone is absent in the chicks of Ostrich, Emu, Domestic fowl and megapode.

The form of the opisthotics is highly distinctive in dromornithids (Fig. 22A, B). The rounded post-tympanic crest of the opisthotic is thick and greatly expanded in the parasagittal plane, terminating in a long, slender ventrally-directed process extending from immediately below the external auditory fenestra. The auditory fenestra is situated within a laterally directed cavity formed by the anterior and posterior crests of the opisthotic. The ventral crest of the opisthotic is well-developed, obscuring the auditory fenestra from view in the ventral aspect. Posterodorsal to the auditory fenestra, a thick crest for the adductor aponeurosis defines the posterior margin of the temporal fossa which continues anteriorly to below the base of the postorbital process in the form of a circular fossa.

The morphology of this region differs markedly from that of ratite birds (Fig. 22E, F) in which the crest of the opisthotic forms a cup-shaped arch over the auditory fenestra, while in ventral aspect, the auditory fenestra is quite visible, as the crest terminates posterior to its orifice as a transversely directed flange. In anseriform birds (Fig. 22C,D) the post-tympanic crest is oriented in the parasagittal plane and the ventral crest and tympanic ring encloses the laterally open auditory recess, as in dromornithids. The crest is also more ventrally-directed and elongated than in ratite birds, usually terminating ventrally in a slender, conical process. In galliform birds, the post-tympanic crest is weak and oriented transversely as in the majority of neornithians.

The structure of the postorbital and temporal fossa region of the dromornithid cranium differs markedly from that of the Emu and Ostrich (Figs. 22E,F, 23F–H). In dromornithids the postorbital process is a composite structure consisting of the postorbital lamina of the squamosal and possibly the frontal externally, which fuses with an internal process of the squamosal and pterosphenoid that may be homologous with the zygomatic process. Consequently, the temporal fossa is displaced posteroinferiorly, behind and below the squamosal. In all ratite birds, a large and well-defined temporal fossa is formed between the squamosal (zygomatic process) and the postorbital (frontal) processes (Fig. 23F–I). In many galliform birds (also parrots, frogmouths and diatrymatids) the two processes, which are composed in the former of the squamosal and laterosphenoid dorsally (postorbital process) and the squamosal ventrally (squamosal process), form an arcade around the adductor muscles, recreating a temporal fenestra (Heilmann 1926), (Fig. 23C, I); whereas the two processes (postorbital process of the frontal and squamosal process) remain widely separated in the Ostrich and Emu (Fig. 23F–H). The condition in anseriform birds is like that of dromornithids in that the temporal fossa is situated posteroventral to the postorbital process, which is composed primarily of the squamosal externally and the laterosphenoid internally, though its individual components are not evident in adult birds (Fig. 23D, E).

Cranio-rostral joint. The anterior orbital region, consisting of the posterior processes of the nasals, the lachrymals and posterodorsal premaxillary process is not known. The frontal hinge is composed of a median eminence with a large fossa on either side, floored by a hinge-like process of the orbital roof (orbital flange), that probably articulated with the posterior process of the nasal and perhaps the base of the lachrymal. Below the frontal eminence is a shallow, smooth-

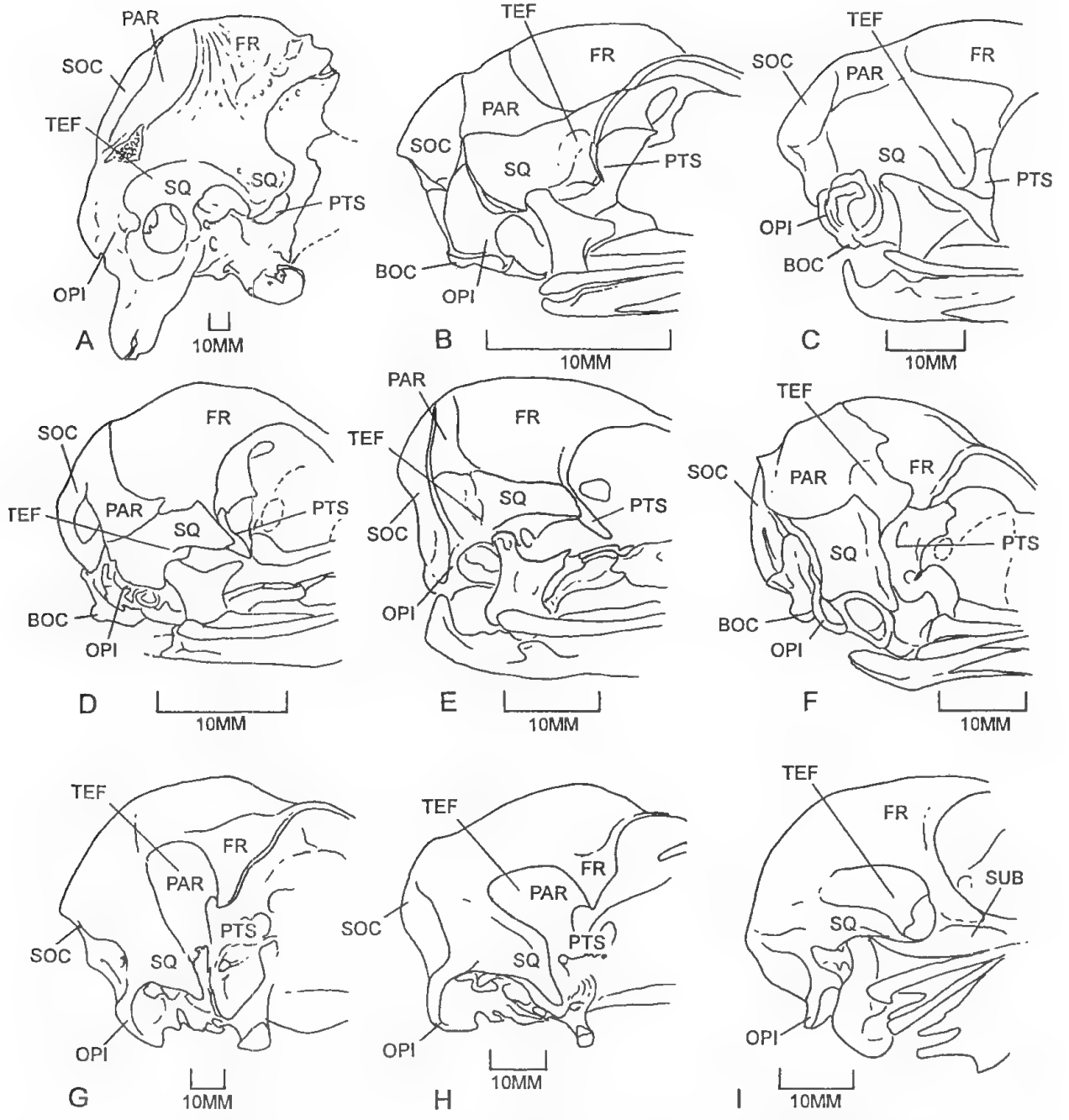


FIGURE 23. Comparison of structure of the cranial sidewall in **A**, *Bullockornis planei*; **B**, Domestic chick, *Gallus gallus*; **C**, adult Domestic chicken, *Gallus gallus*; **D**, domestic gosling, *Anser* sp.; **E**, Pink-eared duck, *Malacorhynchus membranaceous*; **F**, 6-week old Ostrich chick, *Struthio camelus*; **G**, adult Ostrich, *Struthio camelus*; **H**, adult Emu, *Dromaius novaehollandiae*; **I**, cockatoo, *Cacatua* sp. Abbreviations: BOC, basioccipital; FR, frontal; OPI, opisthotic; PAR, parietal; PTS, pterosphenoid; SOC, supraoccipital; SQ, squamosal; SUB, suborbital; TEF, temporal fossa.

surfaced transverse groove denoting the dorsal surface of the mesethmoid and possibly represents the contact with the posterior process of the premaxilla.

Regardless of the specific configuration of the contacts, of which several plausible alternative interpretations can be made, the structure shows similarities with the mobile joint surfaces on the posterior margin of the upper beak of anseriform birds and to some extent also parallels the condition in parrots. Parrots, because of their broad, shortened anteorbital region and deep posterior surface of the beak, present a broad, rectangular cranio-rostral interface with distinct

median frontal and mesethmoidal eminences bordered by fossae on either side. A naso-premaxillary hinge traverses the entire dorsal margin of the joint, the topographical equivalent of which in dromornithids is a rugose, upturned transverse crest. In ducks and geese, the two lateral fossae form hinge-and-socket joints between the anterodorsal prefrontal margin and the descending nasal processes, connected by ligaments. The median part of the hinge is formed by thin, flexible bony processes of the nasal and the premaxilla which are enveloped by an overgrowth of the frontal. The transverse sulcus below the frontal eminence in *Bullockornis* resembles the broken margin of a similarly thin bony lamina.

Ratite crania, which are rhynchokinetic, show no similarities to the distinctive prokinetic dromornithid cranio-rostral morphology. The dorsal lamina of the ethmoid presents an elongated, flattened surface overlain anteriorly by a thin lamination of the posterior process of the premaxilla and is bound-in laterally by the posterior processes of the nasals; whereas in dromornithids, the ethmoid appears to have terminated under the frontal as in parrots, allowing the rostrum to flex to some extent along the joint surface, depending on the nature of its ligamentous attachments (discussed in the following section). Ratites lack a transverse cranio-rostral hinge and the beak is essentially rigid, although varying degrees of rostral kinesis are present in different species depending primarily on the flexibility of the premaxillary arch (Simonetta 1960, Bock 1963).

Rostrum. The upper beak differs substantially in form and structure from those of the Emu and Ostrich. Unlike either of the latter species, the beaks of dromornithids are deep and laterally compressed, with sheer, solid lateral walls apparently composed predominantly of the premaxilla anteriorly and the nasals and maxilla posteriorly. As the only suture visible on the specimens is the maxillo-premaxillary, the precise form and extent of the nasal bone is unknown. The small external narial aperture of *Bullockornis planei* is strikingly similar to that of *Diatryma steini* and *D. gigantea* (Matthew and Granger 1917, Andors 1992).

The beaks of *Dromornis* and *Genyornis* indicate that the maxilla was deep and extended posteroventrally below the jugal process. Consequently, the descending process of the nasal made contact with the maxilla. In dromaeognathous birds, the posterolateral processes of the premaxilla and maxilla are reduced or absent, leaving only the palatal processes, while the descending process of the nasal is closely applied to the premaxilla resulting in a large, confluent anteorbito-narial fenestra (schizorhinous), (Simonetta 1960, Bock 1963). Thus the external surfaces of the beak of dromornithids is clearly unlike those of any living or extinct palaeognath. The structure of the palatal surface of the dromornithid beak also shows an important contrast with paleognaths in its fusion of the maxillopalatines at the mid-line, forming a median process that loosely articulated with the distal end of the prevomer. The vomers were fused into a relatively short, vertical plate that did not contribute a fused ventromedian lamination of the palatal roof as in dromaeognathous ratites. Instead, dromornithids had an extreme form of desmognathous palate.

Cranial base. The morphological details of the basisphenoid differ significantly from the equivalent regions in the Emu and Ostrich. In addition to their nearly conjoined facets, the basipterygoid processes appear to arise a considerable distance distal to the surface of the basitemporal plate as indicated by the position of the eustachian canals and internal carotid (parasphenoidal) foramina. Unlike the Emu and Ostrich in which the eustachian canals are situated laterally at the base of the each basipterygoid process, the eustachian canals in dromornithids are confluent at the mid-line of the basitemporal plate, opening on the posteroventral margin of the basipterygoid rostrum, as typifies neognathous birds (Fig. 24A–H). This complex is related to a subtle difference in the basipterygoid-parasphenoid union. In palaegnathous birds, the basisphenoid contacts the parasphenoid a short distance posterior to the eustachian openings, whereas in neognathous birds, including dromornithids, the basisphenoid sends a thin lamination of bone over the sutural contact, thus enclosing the eustachian canals which initially perforate the basisphenoid in about the same lateral position as in the Ostrich and Emu. In 3-week and 6-week old Ostrich chicks, and presumably adults, the anteromedial ends of the eustachian canals are enclosed by a cartilaginous extension that opens confluently on the mid-line, that is apparently homologous to the bony overgrowth of the basitemporal plate seen in neognaths.

In dromornithids the lateral wings of the body

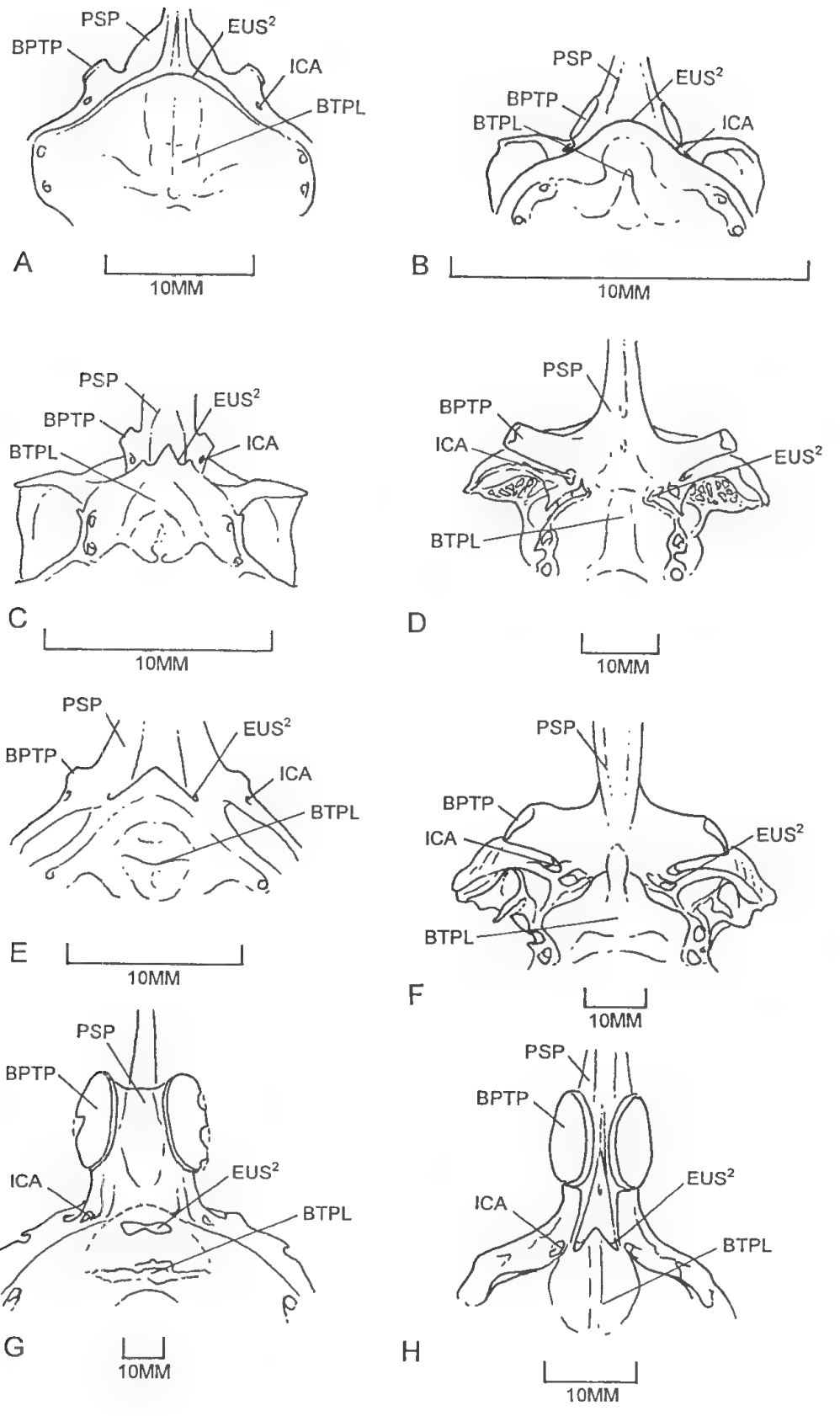


FIGURE 24. Comparison of basipterygoid and rostropterygoid articulations in various palaeognathous and neognathous birds; **A**, Barking owl, *Ninox connivens*; **B**, Button quail, *Turnix velox*; **C**, Partridge pigeon, *Geophaps smithii*; **D**, Emu, *Dromaius novaehollandiae*; **E**, Spotted nightjar, *Eurostopodus argus*; **F**, Ostrich, *Struthio camelus*; **G**, dromornithid, *Bullockornis planei*; **H**, domestic duck, *Anas* sp.

of the basisphenoid (the 'alisphenoid' of Owen) are rounded, sloping surfaces rather than swollen transverse crests forming the anterior wall of the auditory canal in the Emu and Ostrich, nor is there a rugose crest or swelling present along the contact area between the laterosphenoid and the basisphenoid. The equivalent area in *Bullockornis*, *Dromornis* and *Ilbandornis* is occupied by a deep circular fossa for the origin of the protractors quadratus and pterygoideus muscles, very similar to that of many ducks and geese and which are rarely, if ever, as well-developed in other neognathous species (Fig. 22B–D, Fig. 1B). As such, the basic form and relations of the basicranium of dromornithids is a great deal more like those of anseriform birds than to any of the living palaeognaths.

In dromaeognathous ratites the basipterygoid processes arise from the cornua of the basitrabecular cartilage which ossify as laterally-directed stalk-like, tubular outgrowths of the basisphenoid on either side of the base of the parasphenoidal rostrum (Fig. 24D, F). These are present and fully ossified in late embryos of the

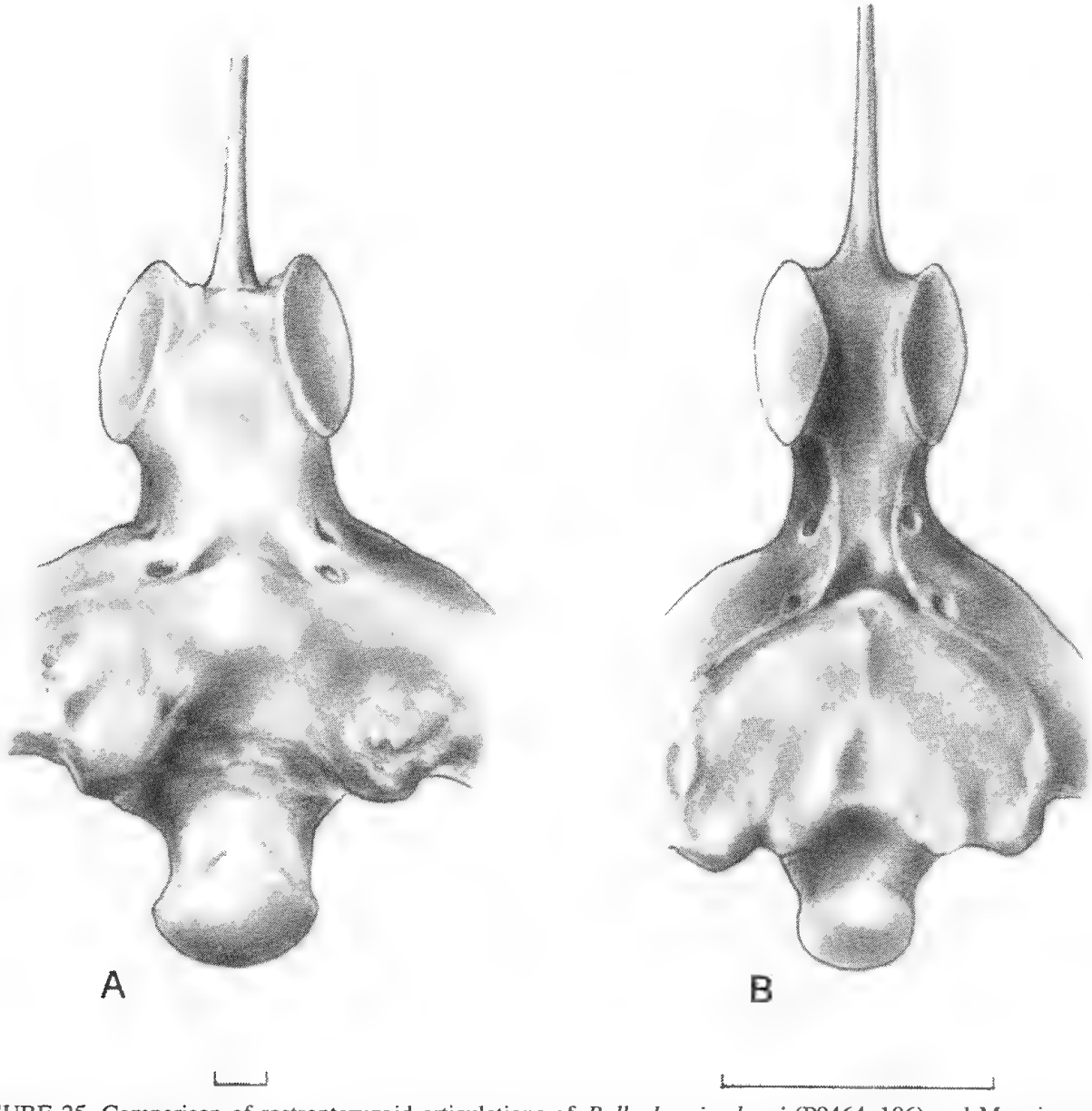


FIGURE 25. Comparison of rostropterygoid articulations of *Bullockornis planei* (P9464–106) and Magpie goose (*Anseranas semipalmata*); **A**, *Bullockornis planei* (chipped margins of facets, margin of eustachian opening and parasphenoidal rostrum partially restored); **B**, Magpie goose (*Anseranas semipalmata*); scale bar=10mm; The rostropterygoid articulations of *Bullockornis* show specific similarities to those of Anseranatidae in that the parasphenoidal rostrum is narrow, the facets are more widely separated than in many other Anseriformes and the interarticular surface of the parasphenoid is flattened.

Ostrich and Emu, whereas the basipterygoid processes of relatively more mature, week-old anseriform and galliform chicks are represented by stalk-less, concave cartilaginous placodes developed over partially ossified bone on the ventral surface of the parasphenoid. The pedicles develop gradually as the birds mature, and appear to arise as an interaction with the contacting surface of the pterygoid. It is likely, therefore, that the basipterygoids (rostropterygoids) of anseriform and galliform birds and by virtue of their close similarity, those of dromornithids, are not strictly homologous with the basipterygoid processes of palaeognathous birds or those of neognathous birds which have true basipterygoid processes (Weber 1993). Some neognathous birds, such as Boobook owls, have both rostropterygoid and basipterygoid processes, indicating that the more anterior (rostropterygoid) facets on the parasphenoid are neomorphic structures.

The position of the facets along the parasphenoid differ in various anseriform species. They are situated closer to the base of the parasphenoid in the Magpie goose and more distally in Black and Pink-eared ducks. The rostropterygoid morphology of *Bullockornis* is very similar to that of a Magpie goose (Anseranatidae), but with the facets directed more ventrally in relation to the parasphenoidal rostrum (Fig. 25A,B). The main difference between dromornithid and anseranatid rostropterygoid morphology appears to be a proportional modification associated with the extreme shortness of the orbito-frontal region, resulting in a steep upward angulation of the parasphenoidal rostrum. The true basipterygoid processes of paleognathous and neognathous birds, while differing in form and length, appear to consistently arise from the same part of the basisphenoid (Fig. 24A–F).

Unfortunately, the interorbital septum and parasphenoidal rostrum are damaged in all dromornithid specimens. The base of the parasphenoidal rostrum is present in P9464–106, indicating that it was narrow and sharply crested on its ventral surface as in *Anseranas*, and angled anterodorsally, hence unlike those of any ratite, though typical of many neognathous birds. Similarly, the mesethmoidal septum appears to have been short and thin, indicating that the rostrum probably did not project beyond the level of the anterior orbital margin.

Quadrate. The quadrates of the Emu and Ostrich closely resemble one another in overall form and in many specific morphological details. The head in both species is elongated and narrow, the quadratojugal tuberosity is a long, stout pedicle with a narrow external articular facet on the ventral surface, widely separated from the internal articular facet by a U-shaped intercondylar fossa. The quadrates of *Bullockornis* have a broad, oval squamosal articular surface, faintly divided into pro-otic and squamosal condyles by a shallow, nearly obsolete intercondylar incisure. The quadratojugal facet is closely applied to the body (Fig. 26A–G) and probably buttressed posteriorly. The external articular condyle was situated close to the internal and divided from it by a shallow groove. The anterolateral crest on the otic process is not present in the Emu and Ostrich. Significantly, the pterygoid articular surfaces in the Emu and Ostrich extend dorsally onto the base of the orbital process to form a wide, essentially immobile joint in contrast to the mobile ball- and-socket joint formed between the quadrate and pterygoid in dromornithids.

The quadrates of anseriform birds are very similar to those of *Bullockornis*, differing in the less distal extent of the anterolateral or otic crest and in possessing (in part) a more distinct intercondylar incisure on the head. It appears that the pro-otic condyle and the squamosal condyle have coalesced or that the pro-otic condyle has been greatly reduced in some dromornithids, especially in *Genyornis newtoni*. While the lateral crest for the *m. adductor mandibulae externus profundus* is well-developed in many species of anseriform birds, it does not extend as far distally in any of the specimens examined in this study, nor is the longitudinal groove on its anterior margin as well-developed or extensive. The quadrate of *Genyornis newtoni* (Stirling and Zietz 1913) is less robust than that of *Bullockornis*; more tapered distally and possesses a more elongated, slender and posteriorly directed otic process. While the *Genyornis* specimens show some proportional differences from those of *Bullockornis*, none of these are in the direction of dromaeognathous ratites.

Pterygoid. Among the three genera of dromornithids for which the pterygoid is known, that of *Bullockornis planei* is the most robust and appears to possess a small distal socket joint, not evident in *Ilbandornis* sp. or *Dromornis stirtoni* (Fig. 27A–C). Both the distal and proximal articular surfaces of the *Ilbandornis* sp. specimen are present, indicating that the bone was short, more or less straight and was not fused to the

palatines as in dromaeognathous birds. Structures and overall proportions are unlike those of any ratite in having mobile joints, the palatine articulation is terminal rather than lateral, and the rostropterygoid facets are situated dorsomedially near the distal end. These features are more similar to galliform and anseriform pterygoids than to those of any other avian order. The quadrate articulation is specifically like those of Anseriformes in its simple ball-and-socket configuration. The palatine articulation of *Bullockornis planei* and perhaps that of *Dromornis stirtoni*, which is damaged in this area, appear to have been differentiated into a dorsomedial process and a small ball-and-socket joint or second process, whereas in *Ilbandornis*, the palatine joint shows no evidence of gomphosis and a separate dorsomedial process is absent.

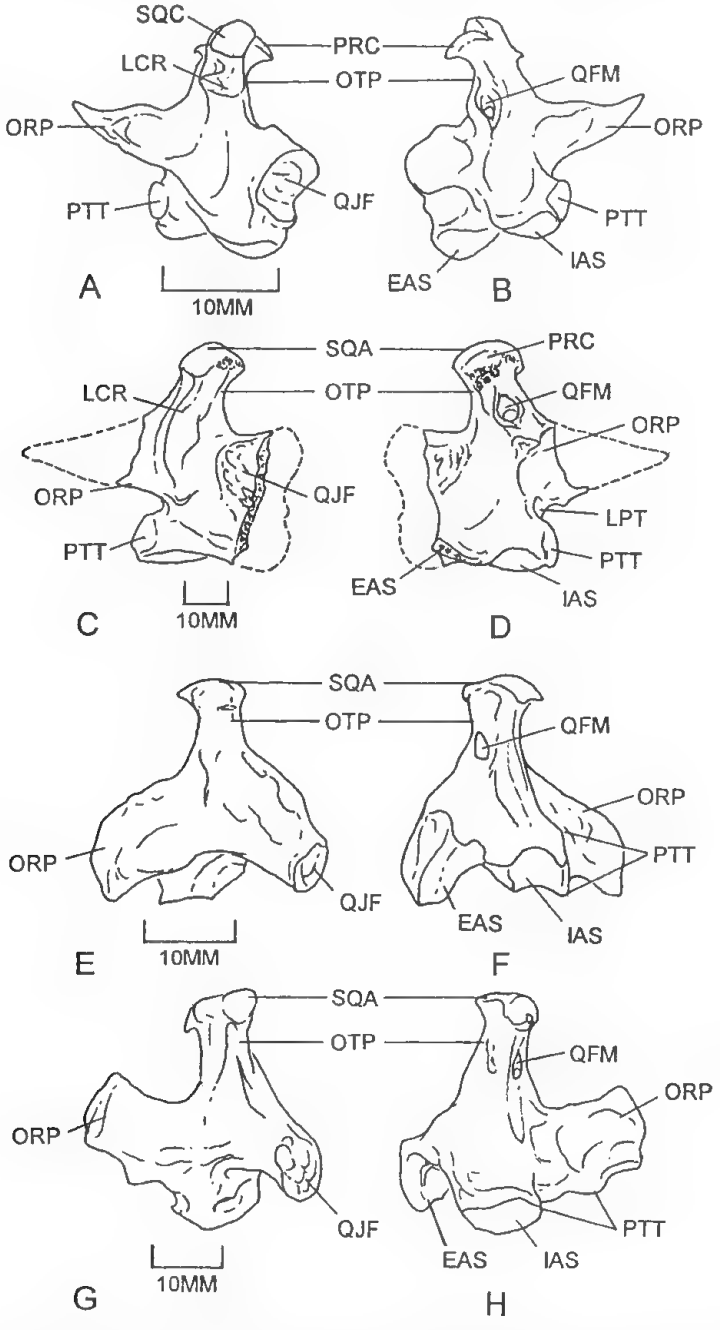


FIGURE 26. Comparison of quadrates in: **A** & **B**, domestic duck, *Anas platyrhynchus*; **C** & **D**, dromornithid, *Bullockornis planei*; **E** & **F**, Emu, *Dromaius novaehollandiae*; **G** & **H**, Ostrich, *Struthio camelus*. Abbreviations: EAS, external articular surface; IAS, internal articular surface; LCR, lateral crest; LPT, scar for pterygoid ligament; ORP, orbital process; OTP, otic process; PRC, pro-otic condyle; PTT, pterygoid tubercle; QJF, quadratojugal facet; SQC/SQA, squamosal articular surface/condyle.

Mandible. The lower jaws of dromornithids are unique among birds in having a pronounced gonial expansion to accommodate its large mandibular adductor muscles. They are also among the deepest avian mandibles relative to their length, surpassing those of *Diatryma*, though less deep in proportion to length than in parrots. Dromornithids have moderately well-developed surangulars, comparable to those of many anseriform birds, but less prominent than in parrots. The coronoids are subdued like those of parrots. The postarticular process is elongated, straight in the sagittal plane, relatively narrow transversely and hooked upwards, a feature to varying degrees of galliform, phoenicopteriform and anseriform birds, but not ratites. Approximately half of the delicate distal point of the postarticular process of *Dromornis stirtoni* is missing (Fig. 17). However, the base of the mediolaterally-compressed process indicates that it curved anterodorsally as in anseriform birds and was not abruptly angled posterodorsally as in galliform birds. The articular fossa is distinctly more galliform or anseriform-like than anything

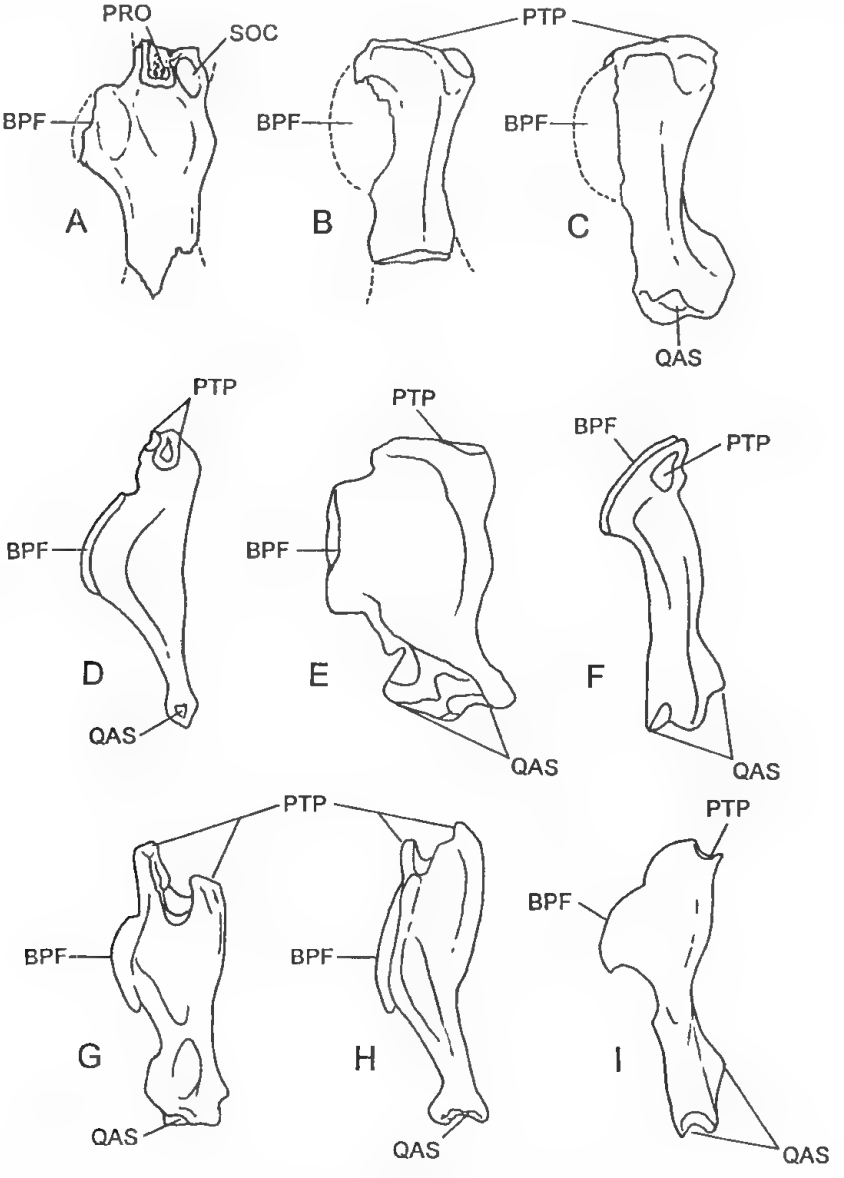


FIGURE 27. Ventral aspects of left pterygoids of: **A**, ?*Bullockornis planei* (Dromornithidae); **B**, *Dromornis stirtoni* (Dromornithidae); **C**, *Ilbandornis* sp. (Dromornithidae); **D**, *Chauna torquata* (Anhimidae); **E**, *Diatryma gigantea* (Diatrymidae); **F**, *Meleagris gallopavo* (Phasianidae); **G**, *Anas* sp. (Anatidae); **H**, *Anseranas semipalmata* (Anseranatidae); **I** , *Megapodius reinwardt*, (Megapodiidae); drawn to the same length for comparison; **D–F** after Andors (1992). Abbreviations: BPF, basipterygoid facet; PRO, base of palatine articular process; PTP, pterygo-palatine articular facet; QAS, Quadrate articular surface; SOC, socketed articular surface.

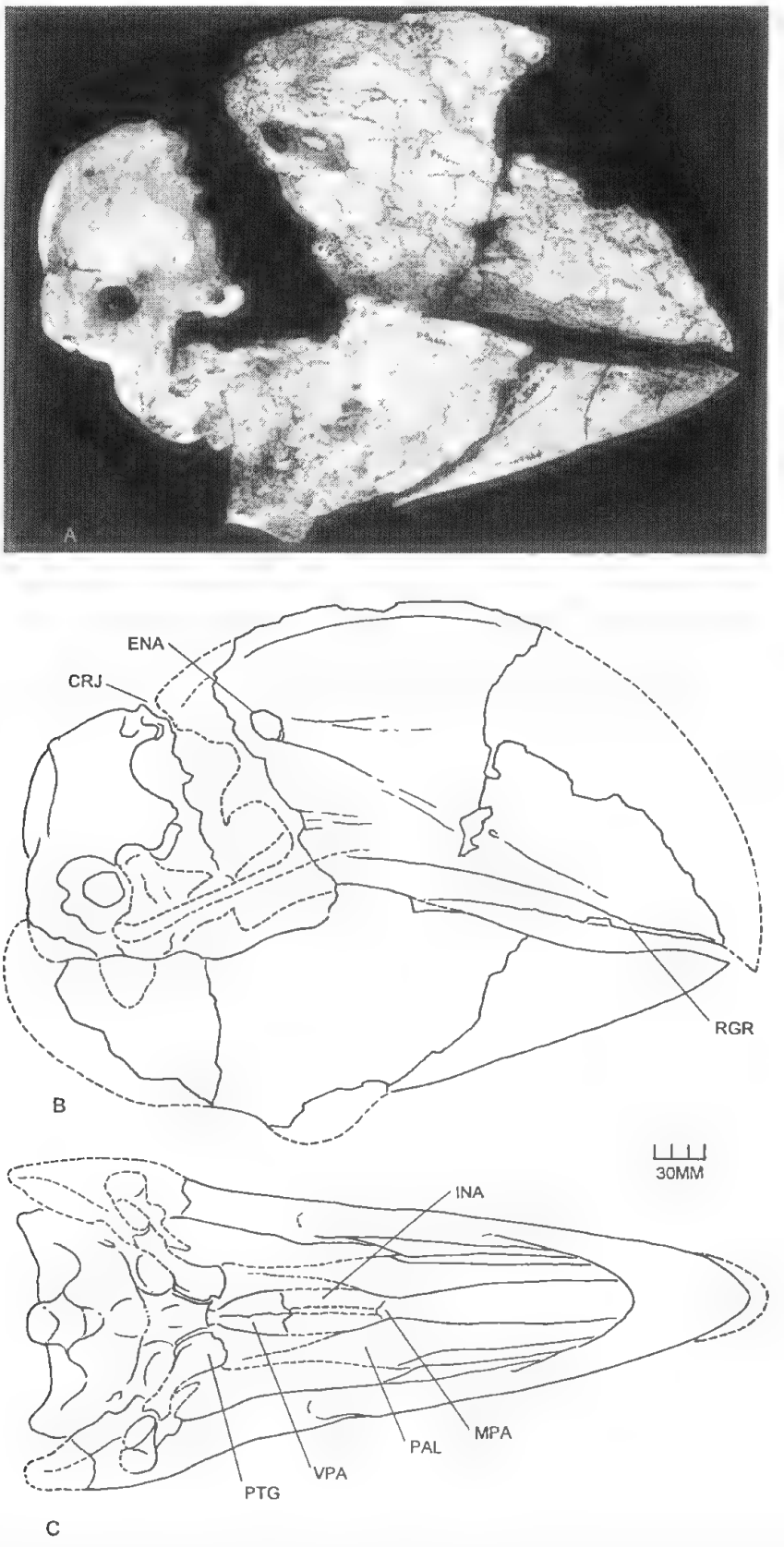


FIGURE 28. Reconstructed elements of the skull of *Bullockornis planei* (P9464–106 cranium; P9464–107 upper beak; P9464–112 mandible); **A**, photograph of reconstructed skull; **B**, line interpretation of lateral aspect, conjectural outlines dashed-in; **C**, line interpretation of ventral aspect. Abbreviations: ENA, external nares; CRJ, cranio-rostral joint; INA, internal nares; MPA, maxillopalatine; PAL, palatine; PTG, pterygoid (based on *Ilbandornis*); VPA, vomeropalatine (fused hemipterygoid-palatine and vomer).

else, and very dissimilar to any ratite. In dromornithids, the posterior mandibular tomia pass outside the uppers as in parrots.

Reconstruction and functional anatomy

Appearance. The skulls of *Dromornis stirtoni* and *Bullockornis planei* are amongst the largest avian crania, rivalling those of *Diatryma* and *Phorusrhacos*. The 460 mm long and 140 mm deep mandible of *Dromornis stirtoni* is about the same size and as robustly constructed as the dentary of a medium-sized horse. The entire skull may have been over 500 mm long. The reconstructed skull of *Bullockornis planei* is slightly smaller. Although the critical area between the frontal and the posterior margin of the upper beak is unknown, the complete mandibles give an accurate indication of their linear proportions and with the quadrate in place, determine the position of the rostral fragments in relation to the cranium (Fig. 28A–C). While large, the skull is by no means disproportional with the postcranial skeleton (Fig. 29), here reconstructed from a combination of *Bullockornis* and *Dromornis* material.

The jaws were long relative to the length of the neurocranium and exceptionally deep, with a slight decurvation of the tip, reminiscent of other large-billed species such as Takahes, puffins, hornbills and cracids but with more specific similarities to the beaks of extinct diatrymatid birds. In dorsal or ventral aspect, the beak is transversely very narrow relative to its height and length and appears to have been much more solidly-constructed than in flying large-beaked birds such as hornbills and toucans.

The main points of conjecture are the anterior orbital region and extent of the rhamphothecae dorsally, and the form of the internal nares and posterior palatines ventrally. Both the upper beak and the mandible of dromornithids have well-developed bony tomial crests indicating deep, thick ramphothecal margins (Fig. 30). In *Bullockornis* the rhinothecal margin appears to have fit inside the gnathothecal crest of the lower jaw. The hollow section of the rhinothecal groove suggests that the tomial surface of the rhinotheca was sulcate, with the lateral margin meeting or slightly overhanging the tomia of the gnathotheca. In species in which the bill sheaths are confined to the tips (nails) and margins, or where the rhamphotheca is thick and actively proliferating, the underlying bone is pitted with numerous foramina. In dromornithids, numerous foramina are concentrated at the tips of the upper and lower beaks and the marginal areas suggesting that much of the upper part of the rostrum and lower part of the mandible was thinly cornified and that well-developed nails were present on the upper and lower bill tips.

The posterior palatine region and form of the internal nares is imperfectly known, but reconstructed on the basis of remnant structures in Figure 28C. It can be discerned that the distal palatines were deep, rather thick vertical crests composed of spongy bone. The posterior element, represented by a fragment of vomeropalatine indicates that the palatines (hemipterygoids) were fused at the mid-line posterodorsally. The width of this fragment suggests that the internal nares were narrow and were probably divided by a short prevomer. The form of the jugal bar is suggested by *Genyornis newtoni*, whereas the shape of the lachrymal is not known.

Functional morphology. Dromornithids have a desmognathous palatal structure very similar to that of ducks, geese and screamers (Fig. 28C). The main difference in the palate relates to the more ventral orientation of the basipterygoid processes relative to the quadratic fossa. This is a proportional adjustment in which the axis of the parasphenoidal rostrum is more inclined in accord with deepening and shortening of the cranium. The deep, short cranium is in turn, a proportional adjustment to the deep rostrum. The quadrates were mobile. Their normal position, with the axis of the body running between the angles of the postorbital process and the base of the opisthotic is indicated by the alignment of the auditory notch between the otic process and the quadratojugal tubercle in relation to the external auditory meatus. With the distal end angled outwards a few degrees and aligned as depicted (Fig. 22C) the articular surface of the quadrates provide sufficient clearance around the neurocranio-mandibular processes and post-tympanic crests for the deeply notched medial surface of the postarticular process.

A rugose crest on the posterodistal margin of the postorbital process indicates the origin of a stout postorbital ligament that inserts on a low tubercle lateral to the external articular process. Depression of the mandible puts tension on the ligament that compels the quadrates to move forward, transmitting the moment through the pterygoids and the quadratojugals to the upper beak, which is elevated accordingly through the dorsal hinge joint. The available leverage for the

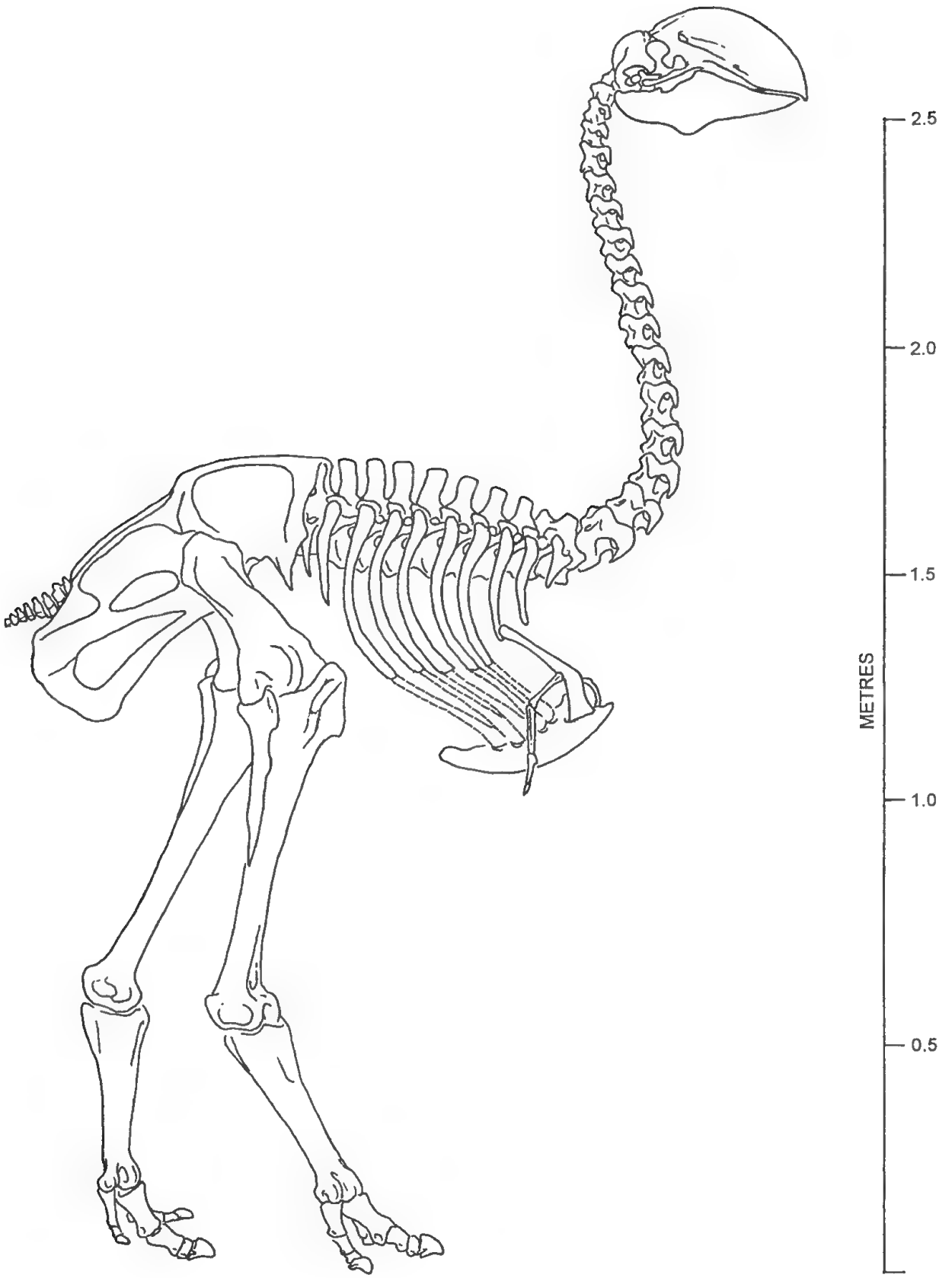


FIGURE 29. Composite reconstruction of dromornithid skeleton, skull and size based on *Bullockornis planei*, postcranial elements based on more complete *Dromornis stirtoni* material. The largest Bullock Creek LF dromornithids were 2.5 to 2.8 metres tall. *Dromornis stirtoni*, the largest Alcoota LF species was 2.7 to 3.0 metres tall. Note massive, short toes, hoof-like unguals and extremely reduced forelimb.

mechanism, as reconstructed (Fig. 28B) would have resulted in a slight elevation of the upper beak as the mandible is depressed.

The median frontal eminence appears to function as a broad fulcrum, probably receiving an overlapping socket joint from the posterior process of the premaxilla. Deep, circular fossae on either side of the eminence may represent reciprocal processes or ligamentous attachments. A distinct cleft may have been present dorsal to the contact over and around which a ligamentous capsule was formed, as indicated by the coronal groove and extensively vascularised dorsolateral surfaces of the frontals (Figs 1A, 2, 3B,C, 28B, 30). The coronal groove, which traverses the dorsal margin of the joint commencing from behind each lateral process of the frontal, is reminiscent of a bursal fossa associated with synovial joints. The lateral process of the frontal seems to anticipate a similar projection of the posterior end of the prefrontal to which it was probably joined by a ligament.

The numerous low crests and foramina indicate the extent and orientation of connective tissue tracts extending in a series of arcs from the frontoparietal toward the sulci and fossae emarginating the rostral contacts with the frontal. A bony hinging mechanism is present below and on either side of the frontal eminence in the form of rectangular flanges extending from the dorsal lamina of the orbits. These flanges are curved dorsally and appear to have smooth ventral contact surfaces. Oval lateral fossae situated above the hinging processes appear to have accommodated reciprocating processes from the rostrum, perhaps from the nasals or lachrymals. The internal surfaces of these fossae are raised into a series of crests that probably represent internal ligaments.

The breadth, depth and apparent complexity of this joint indicates that its purpose transcended a simple transverse hinge arrangement. The compound structure of the joint could accommodate some rotational movement in addition to dorsiflexion of the beak, while also contributing a component of elastic rebound. It is

FIGURE 30. Restoration of *Bullockornis planei* skull, anteorbital region and jugal bar are conjectures based on anseriform morphology.

difficult to envision what advantage a small increase in gape resulting from strepsostylic elevation of the beak would offer this large-jawed species. However, passive elevation of the beak during shearing or crushing of hard objects situated closer to the mandibuloquadrate joint would serve to optimise forces by reducing the angle of attack of the tomial margins.

Given the enormous size of the beak and the considerable forces exerted along its length by the powerful adductors, the requirement for such a specialised joint is hardly surprising. The deep fossae for the mandibular adductor muscles laterally and the pronounced internal crest for the posterior pterygoid muscles indicate that enormous shearing forces were exerted at the tomial surfaces. The long muscle bellies and their insertions far anterior to the mandibular fulcrum, in combination with the concave toma of the lower jaw and gently convex toma of the upper, suggest a powerful secateuring action capable of severing tough, firm, fibrous material.

Powerful shearing function in long avian jaws requires that the shearing crests retain their original angle of attack as forces on the material between them are increased during the bite. The deep, slab-sided mandibles and thick, deep, rigid symphysis are essential features of this mechanism, but equally important is the postorbital ligament that resists rotational forces on the ipsilateral mandibulo-quadrate joint. The narrow, parabolic, almost parallel-sided arch of the dromornithid mandible minimises axial distortion or twisting by reducing the amount of leverage between the two rami. In biting through resistant three-dimensional material, such as a sizeable stem or twig, a considerable shock, as the stem suddenly parts, might be expected to travel through the jaws despite proprioceptive reactions of the jaw musculature. We suggest that an important additional function of the cranio-rostral joint specialisation in these genera might be to dampen potentially damaging recoil from biting through resistant plant materials.

The tip of the upper beak is moderately decurved and slightly overhangs the lower. While narrow, the tip is U-shaped rather than pointed. The lower tip is U-shaped and slightly up-turned to form a sharply emarginated scoop. This is clearly a terminal biting mechanism capable of effecting a strong grip at narrow or moderate gape, and biting into or through tough materials at a wider gape. Although the hooked tip appears well-developed in profile, it differs markedly from the slender, sharply pointed hook in raptors and carrion-eating birds, and from the stouter but equally decurved tip of the beaks of parrots, in being transversely broader at the tip, more rounded in external contour and concave on the inner surface along which the margin of the lower beak normally occludes. It is likely that the lower crest could make edge-on-edge contact with the upper with the quadrates drawn forward by action of the protractor quadratus muscles.

The functional attributes of the jaws of the large-beaked dromornithid genera indicate that they were specialised herbivores equipped to shear tough plant materials such as twigs, petioles, fibrous stems, thick, leathery-skinned fruits, leguminous seed pods, large, hard-shelled seeds and fibrous kernel-bearing nuts. The long neck and great stature of the mid to late Miocene species suggest that they were primarily high-level browsers feeding preferentially in the lower branches of trees in a zone between two and three metres above the ground.

Higher avian relationships

Similarities of the dromornithid post-cranial skeleton to those of ratite birds were considered sufficiently compelling to have previously included them in the Palaeognathae (Stirling and Zietz 1913; Cracraft 1973; Rich 1979, 1980). Among the ratite postcranial features shared by dromornithids are absence of a carina on the sternum, unfused furculae, greatly reduced forelimb, and certain functional attributes of the hind limb associated with a cursorial habitus. Detailed character analyses of dromornithids by Rich (1979, 1980) concluded that dromornithids are more closely related to casuariids than any other ratite group.

Consequently we have examined the morphological evidence as closely as our resources allow in an effort to eliminate the possibility of convergence of a basically ratite condition with that of anseriform or other neognathous orders, and to eliminate any possibility that dromornithids represent a novel avian taxon convergent with the Anseriformes. We also compare dromornithid cranial morphology with other extinct large neognathous flightless birds, particularly the diatrymatids.

Dromornithid cranial characters. Primary or diagnostic features of the dromornithid skull include: 1) short, deep cranium with small orbits, lacking occipital fontanelles; 2) narrow anterodorsally-angled parasphenoidal rostrum

terminating behind the base of the maxillary rostrum (upper beak); 3) compressed mesethmoid not continuous or fused with nasal septum; 4) large, flat, basipterygoid (rostropterygoid) facets closely applied to the parasphenoidal rostrum; 5) eustachian canals open confluently on the midline of the basitemporal plate; 6) ventrally excavated postorbital process composed of fused elements, situated anterodorsal to the quadrate fossa, displacing the temporal fossa posteroventrally; 7) mobile quadrates neither bound into, nor abutted against (absent) zygomatic process; 8) broad, rectangular quadrate with strong lateral crest on otic process, presence of faint intercondylar incisure, well-developed quadratojugal buttress and condylar pterygoid articular surface; 9) short pterygoids with distal basipterygoid facets and condylar pterygopalatine joint (possibly with process and socket); 10) proximomedian conjoined palatines not situated lateral to pterygoids; 11) large, wing-like post-tympanic crests in parasagittal plane, opisthotic process traverses base of auditory fenestra; 12) deep fossae in the laterosphenoids for *mm. protractores et levatores quadratus+ pterygoideus*; 13) complex transverse prokinetic cranio-rostral joint situated posteriorly over the orbits with associated ligament tracts and sulci on cranial surface; 14) maxillopalatines fused at midline forming internal nares and median process with articular eminence for the prevomer (desmognathous palatal structure); 15) long, deep laterally compressed beaks; 16) solid lateral wall of upper beak, with deep maxillary process and broad maxillo-nasal contact, maxillopalatines situated ventral to jugal process; 17) small holorhinal external narial aperture; 18) solid, highly-fused mandibular elements, quadratic articular surface divided by distinct *crista intercotyla*, ventral mandibular groove absent and conical recess poorly developed; 19) long, laterally compressed, hooked retroarticular processes oriented in parasagittal plane.

Unique dromornithid characters. The prodigious body size of dromornithids combined with their particularly large skulls introduces conspicuous proportional differences from other bird crania, even in comparison with the largest living and extinct ratite species. Readily identifiable allometric features of the dromornithid cranium are the relatively small size of the orbits, enlarged crests and processes for muscle attachments and differential growth between the inner and outer table of the braincase in which the external surface is considerably expanded by air cells around the endocranial cavity. The posterior position of the basipterygoid facets and apparently very short, upwardly-angled parasphenoidal rostrum appear to be proportional adjustments to the short, deep cranium. Other uniquely dromornithid characters such as the elaboration of the cranio-rostral joint are associated with the large beak and powerful adductors.

Palaeognathae. As the postcranial skeletons of dromornithids were considered to have numerous general and some specific features in common with certain ratite birds, in particular with Casuariidae (Rich 1979), we initially anticipated some ratite similarities in the structure of the cranium and mandibles. The first complete elements recovered were the mandibles, which showed no ratite similarities in structure or form. Previously known quadrate fragments and several pieces of the back of the cranium including the distinctive post-tympanic crests, occipital condyle and orbital margin were also unlike those of any known ratite. Each new fragment rendered the possibility of finding any ratite features increasingly remote, reinforcing Olson's (1985:105) observation that '...if *Genyornis* may be taken as representative of the Dromornithidae as a whole, then this family must have been derived from some group altogether different from the ratites'. Based on some newly prepared Bullock Creek material, Rich (1991) stated that the basicranial structure is not typically ratite or galliform and concluded that the skull is so highly derived that it is difficult to associate them with any known avian group.

We unequivocally confirm Olson's (1985) and Rich's observations (1991) that dromornithids and ratites have no specific cranial attributes in common and that their postcranial similarities, such as can be found, are parallelisms related to flightlessness, cursoriality and large body size. Following Bock's (1963) and Simonetta's (1960) assessments of ratite cranial characters, dromornithids differ from ratites in: 1) possessing a short vomer not anteriorly fused to the palate; 2) the palatines are not laterally deflected; 3) the longer span of the pterygoid is between the quadrate and the basipterygoid facet, and the pterygopalatine joint is a mobile synovial joint; 4) the basipterygoid facets are situated more anteriorly on the parasphenoidal rostrum and lack stalk-like processes; 5) the orbital and nasal septae are not continous and a transverse nasofrontal hinge is present; 7) the maxillary processes of the upper beak appear to have been

fused to the descending process of the nasals and 8) the quadrate is independent of the zygomatic process, neither abutted to it, nor rendered sessile in its proximity by ligaments. Some additional, utterly non-ratite attributes include: 9) absence of zygomatic process or fusion of its homologue to the postorbital process, displacing the temporal fossa to behind and below the squamosal component rather than between the postorbital process (frontal) and zygomatic process (squamosal); 10) anteroposteriorly oriented, wing-like form of the opisthotics; 11) topology of the basicranial foramina and narrowness of the basitemporal plate; 12) confluent median emergence of the eustachian canals; 13) form and relations of the quadrate fossa; 14) morphology of the quadrates; 15) relations and form of the auditory meatus; 16) fusion of mesethmofrontal and form of interorbital septum and 17) median fusion of the maxillopalatines excluding the vomer (desmognathous palatal structure).

Psittaciformes. Rich (1991) noted several parrot-like similarities to dromornithids which are considered to be convergences related to herbivorous diet. These include large, powerful rostrum; small, holorhinal external nares; mobile, wide cranio-rostral joint and simple-headed quadrate.

Ciconiiformes. Similarities between dromornithids and ciconiiform birds include desmognathous palate, holorhinal nostrils and prenarial furrows or grooves. The maxillopalatines of threskiornithids, (*Threskiornis, Platalea*) are hypertrophied and spongy, filling the base of the beak much as in *Bullockornis.* However the complex condylar morphology of the quadrate, absence of parasphenoidal and pterygoid basipterygoid facets, transversely expanded and inferiorly directed postarticular processes of the mandibles in this order differ substantially from the equivalent structures in dromornithids. Ericson (1997) considers Ciconiiformes to represent the sister-group of Phoenicopterids.

Phoenicopteriformes. Flamingos, like threskiornithids, have hypertrophied, spongy maxillopalatines in common with dromornithids. They also resemble anseriform birds in possessing prolonged, recurved postarticular processes. However the basipterygoid processes are rudimentary and the cranium is otherwise similar to the Ciconiiformes with which they are sometimes included as a family. Ericson (1997) places phoenicopterids as the sister-group to Anseriformes. The long neck and large, down-curved beak of the flamingo imparts a superficial resemblance to our reconstruction of *Bullockornis* (Fig. 28).

Gruiformes. With the exception of desmognathous cariamids, all other gruiform birds are schizognathous and all lack basipterygoid processes. The postarticular processes are truncated and transverse. Diatrymatids were considered to have been related to Gruiformes during the late nineteenth century (Andors 1992). Gruiform birds have no particular similarities with dromornithids.

Charadriiformes. Olson and Fedducia (1980) conclude that Anseres were derived from Charadriiformes based on a mosaic of characters in *Presbyornis.* Charadriiform ancestry of Anseriformes is rejected by both Livezey (1997) and Ericson (1997).

Galliformes. Livezey (1997) and Andors (1992) recognise Galliformes as the sister-group of the Anseriformes. Galliform birds, in common with Anseriformes and Dromornithidae have well-developed rostropterygoid facets and elongated, reflected postarticular processes. They also share similarities in the mandibular articulation and suspensorium (Andors 1992). The curassow-like beak, holorhinal nostril and imperforate occiput of dromornithids are also reminiscent of galliforms. However, Galliformes are schizognathous and show a number of differences in the cranium, in which a secondary temporal arcade is usually present (Fig. 23C) and in specific features of the quadrate (wide incisure of otic process, weak adductor crest, truncated medial mandibular condyle) and postarticular process (shallower, less compressed, shorter).

Anseriformes. Dromornithids and anseriform birds, exemplified by screamers, ducks and geese, exhibit a considerable number of close morphological similarities that are not found *en suite* in other avian species. Among these are: the possession of rostropterygoid facets closely applied to the parasphenoidal rostrum; excavated postorbital process and absence of zygomatic process; topology of the cranial base and its foramina; form and anteroposterior orientation of the post-tympanic crests of the opisthotics; overall similarity of the quadrates (intercondylar incisure shallow, large adductor crest, elongated obliquely

oriented medial mandibular condyle); short distal process of the pterygoid with socket and process (in part) and distomedial position of basipterygoid facets; hemipterygoids fused to prevomer; maxillopalatines fused in mid-line forming anterior margin of internal nares (desmognathous palate); deep fossae in the laterosphenoids for the *mm. protractores et levatores quadrati+ pterygoidei*; morphology of the endocranial cavity, and long, compressed, upturned postarticular processes. While some features (e.g. form of basipterygoid [rostropterygoid] processes and distal basipterygoid facets of the pterygoids) are shared with galliform birds, the form of the quadrates, possession of desmognathous palate and form of the postorbital process and temporal fossa are sufficient grounds for rejecting a galliform relationship.

In terms of character states with widely agreed upon polarity determinations (Andors 1992, Livezey 1997, Ericson 1997), the Dromornithidae are synapomorphous with Anseriformes in possessing: 1) rostropterygoid facets as opposed to true basipterygoid processes; 2) postorbital process concave posteriorly, zygomatic process absent; 3) hooked, compressed retromandibular process in sagittal plane; 4) prominent medial mandibular process; 5) articular fossa of mandible divided by prominent intercondylar crest; 6) craniofacial flexion zone transverse, buttressed by eminences of the frontal; 7) absence of rhynchokinesis; 8) maxillopalatine forming continuous osseous palate; 9) (possible) rudimentary gomphosis (in part) of pterygopalatine articulation; 10) presence of tubercle for adductor mandibularis muscle on lateral surface of the quadrate.

Relationship to diatrymatids and anhimids. Andors (1992) considers the large flightless Euramerican Palaeogene birds of the genus *Diatryma* to represent the sister group of the Anhimidae (Screamers) which are in turn placed within the Anseriformes as the sister group to the Anseranatidae (Magpie geese) and the Anatidae (typical ducks and geese). This hypothesis has much in common with the present observations on dromornithid relationships. While the diatrymatid characters employed in Andors' (1992) cladistic analysis pertain as much to the postcranial skeleton as to the skull, several important features can be compared. The palatal and cranial base elements of all *Diatryma* species are poorly preserved, but such as exist indicate a desmognathous palate.

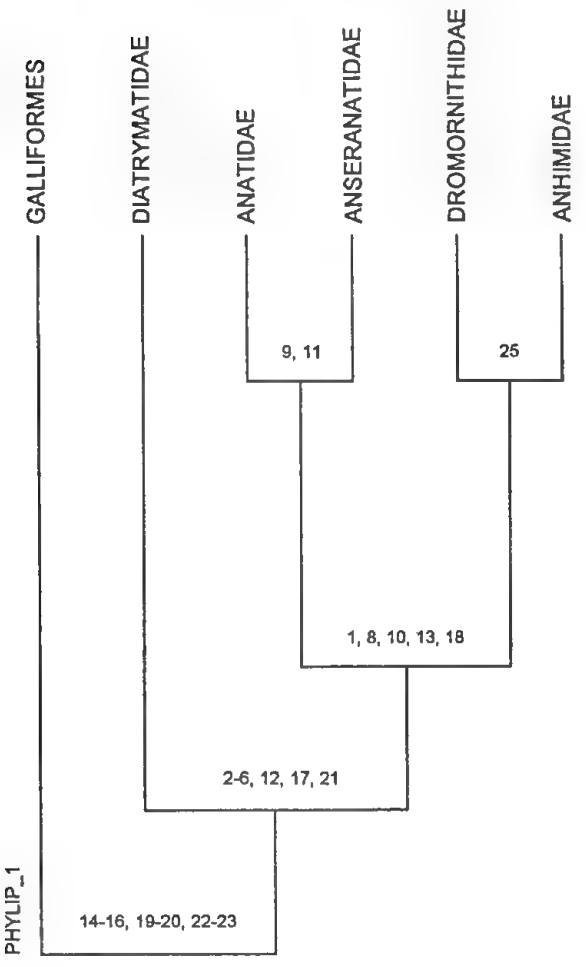
More detailed similarities include a greatly shortened neurocranium, large compressed, moderately hooked (non-raptorial) beak, solidly fused mandibular elements with elongated hooked, retroarticuar processes, prominent and massive post-tympanic crest, basic form of the pterygoids, broad quadrate with well-developed anterolateral crest or process for the *m. adductor mandibulae externus*, and condylar articular tubercle for the pterygoid, while however, retaining a distinctly separated pro-otic condyle, reduced and/or poorly differentiated in dromornithids.

A conspicuous similarity is the small, posteriorly situated holorhinal external narial aperture. The postcranial skeleton of *Diatryma* is clearly less specialised than in dromornithids in the retention of digit I, a pygostyle, and less reduction of the forelimb. As in anhimids and dromornithids, the diatrymatids lack uncinate processes (Matthew and Granger 1917, Andors 1992). As Andors (1992) points out, *Diatryma* retains many galliform symplesiomorphies, among which he includes the holorhinal impervious nares, upper temporal fenestra, and simple abutting pterygo-palatine articulation.

With the exception of the (possibly homoplasious) absence of uncinate processes, dromornithid-anhimid similarities are largely symplesiomorphic within Anseriformes, based on character polarities determined by Andors (1992) and Ericson (1979), e.g.: 1) absence of occipital fontanelles; 2) angled parasphenoidal rostrum; 3) absence (in part) of pterygopalatine ball and socket joint; 4) narrow beak; 5) shallow conical recess of mandible; 6) presence of pneumatic foramen of medial mandibular process; 7) absence of ventral groove in anterior portion of mandible.

Possibly of phylogenetic significance is the difference between the basipterygoid processes of anhimids and dromornithids (and all other Anseriformes). Anhimids appear to have a true (reptilian-type) basipterygoid articulation (Ericson 1997) whereas dromornithids clearly possess rostropterygoid articulations with marked similarities to those of *Anseranas* (Fig. 25A,B). The basipterygoid articular surface of the pterygoid is also closer to mid-shaft position in anhimids (Fig. 27D), whereas in dromornithids and all other Anseriformes, the facet is situated at its distal extremity. Given the wide range of expression of basipterygoid articulation within other non-passerine orders, the anomalous condition in the Anhimidae might be interpreted as a reversal.

The inclusion of the characters of *Bullockornis*,



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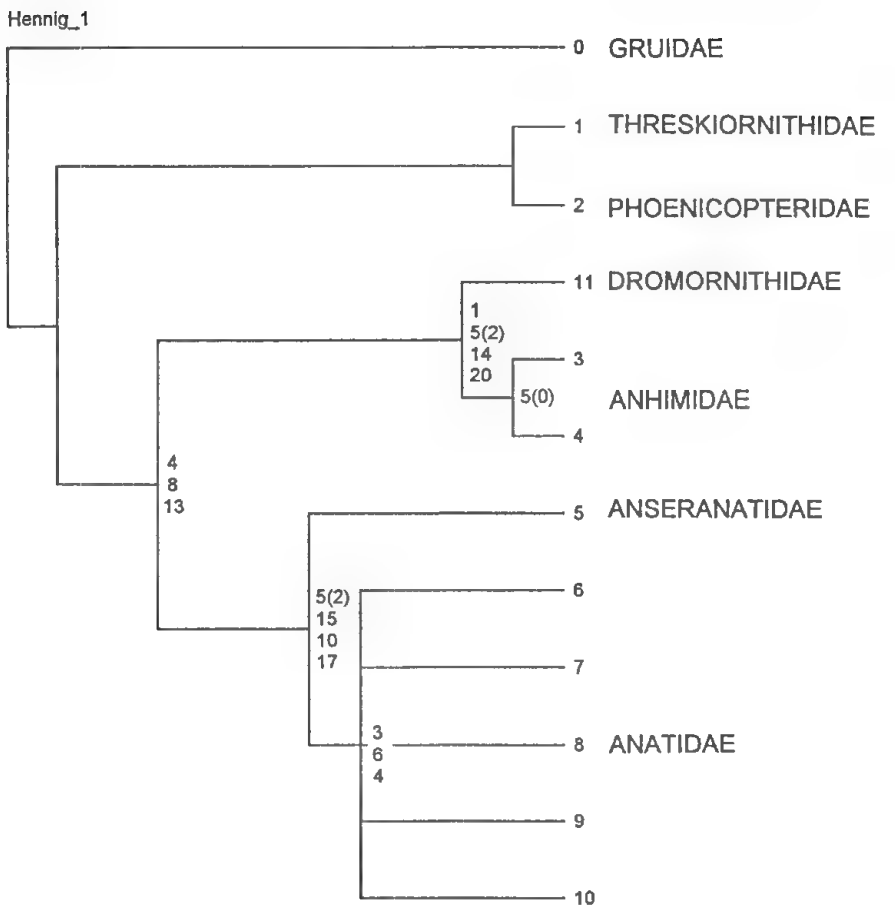
DIATRYMATIDAE	0	1	1	1	1	1	1	0	0	?	0	1	0	1	1	1	1	0	1	1	1	1	1	0	?
ANHIMIDAE	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1
ANSERANATIDAE	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
ANATIDAE	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
DROMORNITHIDAE	?	1	1	1	?	?	0	1	0	1	0	1	1	?	1	1	1	1	1	1	1	1	1	0	1

FIGURE 31. Dendrogram of dromornithid relationship within Anseriformes based on character states **1–25** (skull+two postcranial characters) abridged from Andors (1992), *Megapodius* (Galliformes)=outgroup species; polarity code (see Andors 1988, 1992 for full descriptions): 0=primitive, 1=derived; defined as follows: **1,** nasal septum: imperforate 0; perforate 1; **2,** external nares: elongate 0; restricted to posterior position 1; **3**, premaxilla labial process: slender 0; deep 1; **4**, nasal-frontal hinge: flexion zone indistinct 0; distinct crease 1; **5**, lacrimal head: joined to nasal bar 0; moderately developed or large, situated beneath nasofrontal hinge 1; **6**, lacrimal descending process: poorly developed and pointed 0; short, broad 1; **7**, orbital rims: thin 0; thick 1; **8**, zygomatic process: forms a temporal fenestra 0; temporal fossa reduced, displaced posteroventrally 1; **9**, occipital fontanelles: absent 0; present 1; **10**, bony palate: schizognathous 0; desmognathous 1; **11**, pterygoid: pterygo-palatine articulation: simple abutment or peg and socket 0; ball and socket involving two extensions of pterygoid 1; **12**, pterygoid: position of basipterygoid facets, anterior 0; medial, forming an extensive flange; **13**, basipterygoid processes: sessile 0; almost pedicellate 1; **14**, quadrate: otic process, wide incisure 0; narrow or obsolete incisure 1; **15**, quadrate: anterolateral crest or process, absent 0; present 1; **16**, quadrate: mandibular condyles, three in number, v-shaped configuration 0; two in number, bilobate lateral condyle larger more bulbous than medial 1; **17**, quadrate: medial condyle, rounded, truncated medially 0; compressed, elongated anteromedially 1; **18**, quadrate: posterior buttress of jugal, small 0; large 1; **19**, mandible: articular fossa, v-shaped 0; bipartite, cotyla and intercotylar crest directed anteromedially 1; **20**, mandible: lateral mandibular process, unknown state 0; rounded and prominent 1; **21**, mandible: medial mandibular process, spike-like, without anterior facet 0; expanded distally and facetted; **22**, mandible: retroarticular process, absent or poorly developed 0; long, upwardly curved 1; **23**, mandible: retroarticular process, slender and rounded 0; laterally compressed and blade-like 1; **24**, caudal vertebrae: hypocentra, well developed 0; poorly developed 1; **25**, ribs: uncinate processes, present 0; absent 1. PHYLIP (Felsenstein 1995), Wagner parsimony, 1 tree; 23 steps.



		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	*Grus*	1	0	0	1	0	0	0	0	0	1	0	0	0	7	0	0	0	1	0	0
1	*Threskiornis*	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
2	*Phoenicopterus*	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
3	*Anhima*	0	0	0	1	0	0	0	1	0	0	1	1	1	0	0	0	0	1	1	1
4	*Chauna*	0	0	0	1	0	0	0	1	0	0	1	1	1	0	0	0	0	1	1	1
5	*Anseranas*	1	0	0	1	2	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0
6	*Dendrocygna*	1	0	1	1	2	1	1	1	1	1	1	1	1	2	1	1	1	0	0	0
7	*Thalassornis*	1	0	1	1	2	1	1	1	1	1	1	1	1	2	1	1	1	0	0	0
8	*Stictonetta*	1	0	1	1	2	1	1	1	1	1	1	1	1	2	1	1	1	0	0	0
9	*Anser*	1	0	1	1	2	1	1	1	1	1	0	1	1	2	1	1	1	0	0	0
10	*Tadorna*	1	1	1	1	2	1	1	1	1	1	0	1	1	2	1	1	1	1	0	0
11	*Bullockornis*	0	0	0	1	2	?	0	?	0	0	1	1	1	0	0	1	0	0	0	1

FIGURE 32. Dendrogram depicting dromornithid relationships within Anseriformes based 17 cranial and three postcranial characters abridged from Ericson's (1997) matrix; Gruidae (*Grus*) outgroup; characters and polarity code (see Ericson [1997] for full descriptions): **1**, occipital fontanelles: present 0; absent 1; **2**, frontal narrow and laterally rounded, yes 0; no 1; **3**, cranium and lacrimals co-ossified: unfused 0; fused 1; **4**, ventral surface of postorbital process distinctly excavated: no 0; yes 1; **5**, basipterygoid processes: true (reptilian) 0; absent 1; rostropterygoid 2; **6**, ventral margin paraspenoidal rostrum: clearly angled 0; gradually sloping 1; **7**, pterygopalatine articulation ball and socket with 2 processes: no 0; yes 1; **8**, internal lamina of pterygoids obsolete: no 0; yes 1; **9**, position of jugal process of maxilla relative to maxillopalatine: dorsal 0; ventral 1; **10**, bill broad, spatulate: no 0; yes 1; **11**, quadrate, lateral view: not squarish, deeply curved dorsal margin 0; squarish, dorsal margin straight 1; **12**, quadrate, mandibular process inflated behind quadratojugal articulation; no 0; yes 1; **13**, mandible, quadrate articulation: three-condyle articulation with medial and lateral cotyla separted by a shallow groove 0; two-condyle articulation with medial and lateral cotyla separated by an anteroposteriorly oriented intercotylar crest 1; **14**, mandible, conical recess: absent 0; shallow 1; deep 2; **15**, mandible, pneumatic foramen in medial mandibular process: present 0; absent 1; **16**, mandible, lateral mandibular process: absent 0; present 1; **17**, mandible, groove in ventral surface of anterior portion of mandibular rami: absent 0; present 1; **18**, thoracic vertebrae, notarium present: yes 0; no 1; **19**, caudal-most thoracic vertebrae are pleurocoelous: no 0; yes 1; **20**, uncinate processes on ribs: present 0; absent 1. HENNIG 86 version 1.5 (Farris 1988); consistency index= 0.78, retention index= 0.91, Nelson consensus based on 4 trees.

Dromornis and *Ilbandornis* in Andors' (1992) matrix of character states for the skull and two postcranial states (Andors' characters 1-25) with Galliformes outgroup results in a phylogenetic hypothesis that recognises dromornithids as the sister group of anhimids and diatrymatids as the sister group of Anseriformes (Fig. 31). As Andors (1992) found with *Diatryma*, dromornithids express a mosaic of character states. In the case of dromornithids, some characters are highly derived in the direction of anseranatids and anatids (rostropterygoids, temporal fossa-auditory region and quadrate morphology) and others that are plesiomorphic anhimid and galliform-like states (non-spatulate bill, absence of ventral groove, composite structure of postorbital process, simple (in part) pterygopalatine articulation).

It is possible that some derived characters are parallel developments while others, such as the simple, galliform-like abutting pterygopalatine joint in *Ilbandornis*, might represent a secondary (reversed) state. In general, the dromornithids appear to be far more derived in the direction of anhimids, anseranatids and anatids than are the diatrymatids. This phylogenetic hypothesis seems compatible with the phenetic or synmorphological appraisal of the descriptions and comparisons above, and implies that the loss of flight and certain similarities in cranial structure between dromornithids and diatrymatids are parallelisms.

Using Ericson's (1997) rather different matrix of cranial characters and two postcranial states (characters 1–20), with *Grus* as outgroup, the position of the Dromornithidae as the sister group of the Anhimidae remains the same, regardless of the recognition of different types of basipterygoid articulations and change of outgroup (Fig. 32). While the position of dromornithids among Anseriformes is unaffected by the two different outgroup selections, the position of diatrymatids, in having possible closer affinity with Galliformes (Andors 1992) might change in the context of Ericson's (1979) more inclusive matrix.

Biogeography

The ratite-dromornithid hypothesis is elaborated by Cracraft (1973) who stresses cladistic patterns as the keystone to understanding biogeographic distributions. Rich's (1979, 1980) cladogram depicting dromornithids as ratites based on postcranial characters provides a neat correspondence to the pattern of southern continents in the late Jurassic-early Cretaceous. However, the anseriform hypothesis of dromornithid relationships provides an equally plausible palaeobiogeographic scenerio.

Anhimids probably represent the most primitive anseriform states and although their earliest records are from the Palaeogene of North America (Andors 1992), it is possible that they originated in the Southern hemisphere during the Cretaceous Period. Anhimids are presently endemic to South America and may, despite their excellent flying capabilities, represent a relict Gondwanan radiation (Livezey 1997). It is possible that dromornithids may have predated the arrival of casuariids which entered Australia via land connection with Antarctica at some time before about 45 million years ago.

As with many rallid species, which arrived on various continents and islands by flying there, later to become partially or wholly ground dwelling, it is possible that an anhimid-like ancestor of dromornithids adapted to a cursorial habitus in the initially ratite-free Australian land mass. Andors' (1992) observations on the herbivorous bulk-feeding diet being disadvantageous to a flying animal are appropriate here. The high diversity of mid to late Tertiary dromornithids suggests that they had commenced radiation before the arrival of casuariids, which have maintained a comparatively low diversity at least since the mid-Tertiary.

The phylogenetic implications of dromornithid biogeography are that primitive Laurasian Anseromorphae gave rise to gastornithiforms (diatrymatids+gastornithids) (Andors 1992) and ancestral anhimids, the latter having either originated in, or migrated to South America where they radiated and dispersed to Australia and perhaps Antarctica. Dromornithids arose from a terrestrially adapted anhimid-like bird that paralleled the diatrymatids in skull morphology and converged with ratites in postcranial morphology.

Conclusions

In proposing anseriform affinity of dromornithids on cranial evidence alone, it is important to recollect that the postcranial skeletons of Dromornithidae have long been considered to be very similar to those of ratites, particularly the casuariids. In addition to the long neck, extreme reduction of the wing and loss of carina and apparent similarities of the hind limb segments, down to the detail of loss of the hallux have been recognised. Rich (1981) identified 19

shared derived states between dromornithids and casuariids. Differentiation within the Dromornithidae resulted in a range of postcranial adaptations from Ostrich-like (*Ilbandornis*) to gigantic cursorial forms with somewhat Cassowary-like ratios of the limb segments (*Dromornis*), (Stirling and Zietz 1913; Rich 1979, 1981).

Our nearly completed re-evaluation of the dromornithid postcranial skeleton fully supports the cranial evidence for anseriform affinity, but also does not find as a high degree of convergence as might be anticipated, in the synsacrum and hind limb with struthioniformes (Casuariidae and Struthionidae) or any other palaeognathous ratite. Relative hind limb segment lengths of at least two genera of dromornithids are more similar (*Genyornis newtoni* is identical) to that of *Anseranas semipalmata* (Magpie goose) than to those of any ratite. Structural convergences with Struthioniformes are confined to hypertrophy of a single hypotarsal ridge (non-homologous, as different calcaneal ridges are involved) and homoplasious loss of hallux. Conversely, numerous symplesiomorhic states with galliform and anseriform birds are evident, and several clearly defined anseriform synapomorphies are present in states of sacrum, distal femur, proximal tibiotarsus, and proximal tarsometatarsus.

The possibility of convergence in some morphological complexes emphasises the necessity to examine and compare all anatomical components as widely and in as much detail as the specimens permit. Our observations suggest that many, if not all of the character similarities that have been proposed between dromornithids and ratites are isolated expressions within very different morphological complexes that are disjunct in relation to well-defined morphoclines among purportedly related taxa. Though previous understanding of the ordinal affinity of dromornithids was impeded by the poor preservation of the skull of *Genyornis newtoni*, in the clarity of hindsight, it is also evident that the specimen exhibits sufficient morphological information to have distinguished the dromornithids from the palaeognathous ratites and to have at least recognised their affinity with neognathous birds nearly a century ago.

Palaeontologists who have examined dromornithid material, from Stirling and Zietz (1913), Olson (1985), to Rich (1979, 1980, 1991) have expressed varying degrees of ambivalence about the ratite affinity of dromornithids; in the first place, due to the distinctive morphology of the quadrates and secondarily, due to the absence of any specific character state in the postcranial skeleton that would link them unequivocally to a particular group of ratites. In spite of much conflicting evidence from other parts of the skeleton, the reduced forelimb, acarinate sternum and large size of dromornithids seems to have overwhelmed consideration of any other avian orders. Consequently, with comparisons confined solely to ratites, irrespective of the method of analysis, the only conclusion that could be drawn was that dromornithids were aberrant ratites. This ambiguity of dromornithid relationships has had an effect on their visibility in the literature. Despite the fact that more is known about them than many other gigantic fossil birds, they are only rarely mentioned in general accounts of fossil vertebrates and often ignored in systematic and biogeographic works.

We hope, therefore, that our conclusions, briefly summarised below, will assist in dispelling the perception of the Dromornithidae as the poor relatives of Emus and Cassowaries or as an obscure group of Australian ratites of unknown affinity. Dromornithids actually comprise a large and venerable radiation of uniquely Australian gigantic birds, closely related to screamers, ducks and geese. Unlike casuariids, which are rare as fossils in the Tertiary, dromornithids are abundant and diverse components of Australian Miocene-Pliocene vertebrate palaeocommunities, representing around 25% of the material in Northern Territory Miocene local faunas at Camfield and Alcoota (Murray and Megirian 1992). Elsewhere, dromornithids persisted locally in large numbers as *Genyornis newtoni* until their extinction in the late Pleistocene (Field and Boles 1998).

1) Four genera of Dromornithidae, *Bullockornis, Dromornis, Ilbandornis* and *Genyornis,* are represented by cranial material, *Bullockornis planei* being the most complete. While considerable morphological diversity is shown among these genera, they comprise a well-defined natural group appropriately included in a single family.

2) Two basic trophic adaptations in dromornithids are indicated by the available material. *Bullockornis* and *Dromornis* are characterised by deep, powerful beaks in contrast to *Ilbandornis* and *Genyornis* which have more slender, relatively more elongated beaks. Dromornithids were bulk-feeding vegetarians capable of cropping and breaking into extremely tough plant materials. The tomia of the beaks are differentiated into anterior cropping and posterior shearing functions.

3) Dromornithids had prokinetic crania characterised by a complex cranio-rostral joint composed of a median frontoethmoidal tuberosity, lateral fossae and an extensive ligamentous joint capsule. This mobile joint surface facilitated elevation of the beak during depression of the mandible, and also may have functioned as a dampening mechanism for the absorption of twisting and recoil resulting from sudden failure of resistant plant material.

4) Because of their enormous size, dromornithid skulls have many unusual features attributable to allometry. The orbits are small, the neurocranium is short, crests for muscular attachments are exceptionally large. It is likely that a combination of allometric features and trophic specialisations account for some of the similarities of *Bullockornis* to *Diatryma* that, though they are remotely related within the Anseramorphae, might be mistaken for shared derived characters. These allometric features of giant anseramorphs are in stark contrast to the ratites in which the heads appear disproportionately small relative to their bodies and in which allometrically-controlled proportional sliding is not as pronounced.

5) Dromornithids are placed within the Anseriformes on the basis of shared similarities in the structure of the palate (desmognathous), detailed similarities of the quadrate, structure of the postorbital process and the temporal fossa, distinctive pit-like fossa for the protractor and levator quadratus and pterygoideus muscles in the pterosphenoid, and distinctive form of the basipterygoid (rostropterygoid) processes. The rostropterygoid processes of anseriform and galliform birds appear to arise from a different region of the parasphenoid and develop later than the typical basipterygoid processes of palaeognathous and several neognathous orders (Weber 1993, Livezey 1997). Specific morphological details of these and other structures analysed by Andors (1992) with regard to diatrymatids, indicate that dromornithids represent the sister-group of screamers (Anhimidae). Consequently, supposed ratite-like postcranial features of dromornithids are convergences stemming primarily from the assumption of large body mass and secondarily from terrestrial locomotor specialisation.

6) The postulated close relationship of dromornithids to anhimids has implications for the interpretation of anseriform palaeobiogeography. Because dromornithids may represent an early Gondwanan radiation, it seems more parsimonious to postulate that the anhimids were in the Southern hemisphere, presumably South America, during the Cretaceous and may have originated there. Consequently, while primitive Anseramorphae may have originated in Laurasia, the Anseriformes may have Gondwanan origins.

7) The high diversity and extreme specialisation of dromornithids suggests that their radiation in Australia antedates that of the casuariids. Casuariids show two basic adaptive extremes with minor speciation in each, indicative of a broad spectrum of niche occupation previous to their arrival and establishment on the continent.

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THREE NEW SPECIES OF LEIOPATHES (CNIDADARIA : ANTIPATHARIA) FROM SOUTHERN AUSTRALIA

DENNIS M. OPRESKO

Summary

Three new species of the antipatharian genus Leiopathes are described from the coastal waters of South and Western Australia and Tasmania. Leiopathes secunda sp. nov. is morphologically similar to L. expansa Johnson (1899) and L. grimaldi Roule (1905) but differs from those species in having larger and more numerous axial spines. Leiopathes acanthopora sp. nov. resembles L. glaberrima (Esper, 1788) but has larger spines which extend over a greater proportion of the corallum. Leiopathes bullosa sp. nov. is characterised by the distinctive hemispherical shape of its spines.

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OPRESKO, D. M. 1998. Three new species of *Leiopathes* (Cnidaria: Anthozoa: Antipatharia) from southern Australia. *Records of the South Australian Museum* **31**(1): 99–111.

Three new species of the antipatharian genus *Leiopathes* are described from the coastal waters of South and Western Australia and Tasmania. *Leiopathes secunda* sp. nov. is morphologically similar to *L. expansa* Johnson (1899) and *L. grimaldi* Roule (1905) but differs from those species in having larger and more numerous axial spines. *Leiopathes acanthophora* sp. nov. resembles *L. glaberrima* (Esper, 1788), but has larger spines which extend over a greater proportion of the corallum. *Leiopathes bullosa* sp. nov. is characterised by the distinctive hemispherical shape of its spines.

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Introduction

Very few studies have been conducted on the antipatharian fauna of Australia and Tasmania. In 1878 Studer reported on the antipatharians collected by the 'Gazelle' off West Australia and in the Mermaid Straits at depths of 45–50 fm. Two species were identified: *Antipathes foeniculum* Lamarck (= ?*A. foeniculacea* Pallas, 1766; according to Brook 1889) and *A. pinnatifida* Lamouroux, 1816. Brook (1889) suggested that *A. foeniculacea* might be related to *A. dichotoma* Pallas, 1766 and that *A. pinnatifida* might be identical with *A. ulex* Ellis and Solander, 1786. Both *A. foeniculum* and *A. pinnatifida* are poorly described and it is unlikely that either will ever be accurately identified.

Antipatharians are often inadvertently caught in the nets of fishermen. Such material is usually discarded: however, through the efforts of Karen Gowlett-Holmes and her associates, a large number of corals brought up by local fishermen trawling in the waters off the southern and western coasts of Australia and off Tasmania have been saved and carefully preserved. Among these corals were several specimens similar to species of *Leiopathes* found in the Atlantic and IndoPacific. Closer examination revealed species-specific differences in the morphology, size and density of the axial spines. Consequently, three new species are described. The holotypes and paratypes of the new species are deposited in the South Australian Museum (SAM), Adelaide, S. Australia; schizotypes (pieces of the holotypes or paratypes) of the specimens are deposited in the U.S. National Museum of Natural History (USNM) in Washington, DC.

Taxonomic Section

Order Antipatharia Milne Edwards, 1857

Family LEIOPATHIDAE Haeckel, 1896 (emended)

Diagnosis

Polyps with six primary and six secondary mesenteries. Primary (pm) and secondary mesenteries (sm) complete, attached to both inner wall of oral cone and actinopharynx. Secondary mesenteries located between transverse primary mesenteries (tpm) and sagittal primary mesenteries (spm); two on one side and four on opposite side of transverse axis, with one-half of each complement occurring on each side of sagittal axis; clockwise pattern described by sequence tpm-sm-spm-spm-sm-tpm-sm-sm-spm-spm-sm-sm. New polyps developing from coenenchymal surface between older polyps, as well as at distal end of branchlets.

Discussion

In 1896 Schultze proposed a reclassification of the Antipatharia based on the number of

mesenteries in the polyps. In this scheme the family Antipathidae was divided into three subfamilies, the Dodekamerota with 12 mesenteries, the Dekamerota with 10 mesenteries, and the Hexamerota with six mesenteries (these are invalid names according to the International Code of Zoological Nomenclature, Article 12). The Dodekamerota contained the single genus *Leiopathes*. Haeckel (1896, as cited in Carlgren 1908:134) was the first naturalist to treat the Dodekamerota as a suborder of the Antipatharia and to place *Leiopathes* in a separate family, using the name 'Liopathida'. This taxon, with the correctly emended name Leiopathidae, was subsequently recognized by Bourne (1900, as cited in Carlgren 1908:138), Roule (1905), and Hickson (1906). However, in his study of the Antipatharia of the 'Siboga' Expedition van Pesch (1914) discovered a species of *Cirrhipathes* (i.e., *C. contorta*) whose polyps also possessed six secondary mesenteries. This led van Pesch to conclude that the number of secondary mesenteries was not as significant a taxonomic character as Schultze had assumed. He therefore created a new taxon, the 'Heterotaeniales' to contain both the Dekamerota and the Dodekamerota. The 'Heterotaeniales' was treated by van Pesch as a subtribe of the Antipathidae and included all species with primary and secondary mesenteries, regardless of the number. In the last major revision of the order, Pax (1918) renamed the Heterotaeniales the 'Pleiomerota', and elevated the taxon to the rank of superfamily (the name was not based on a described genus). Within the Pleiomerota, Pax placed the families Antipathidae and Schizopathidae; *Leiopathes* was included in the Antipathidae.

The submergence of the Dodekamerota by van Pesch (1914) was based solely on his finding that *C. contorta* had six secondary mesenteries. However, van Pesch (1914) stated that the additional fifth and sixth secondary mesenteries in *C. contorta* are incomplete, meaning that they extend from the body wall but do not reach to the actinopharynx. In contrast, in *Leiopathes* all the secondary mesenteries are complete. Furthermore, according to van Pesch, the two incomplete mesenteries in *C. contorta* do not reach to the upper end of the oral cone nor do they occupy the same relative position as those in *Leiopathes*. In *C. contorta* they are located between the anterior secondary mesenteries and the primary sagittal mesenteries (van Pesch 1914), whereas in *Leiopathes* they occur between the anterior secondaries and the primary transverse ones (Brook 1889). These differences indicate that the two incomplete mesenteries in *C. contorta* are not homologous to those in *Leiopathes*. Consequently, *Leiopathes* can be viewed as a distinct and homogeneous group meriting recognition at a level above that of genus; therefore, the family Leiopathidae is reestablished here. Considering that the classification of the order has been substantially altered by the removal of the family *Dendrobrachiidae* to the Octocorallia (Opresko and Bayer 1991), the use of a distinct polyp-related character such as the number of mesenteries, seems appropriate for differentiating a family-level taxon. Further study may show that the Leiopathidae merits even higher taxonomic recognition.

Genus ***Leiopathes*** Haime, 1849

Leiopathes Gray, 1840:76 (nomen nudum); Gray, 1842:135 (nomen nudum); Haime, 1849:224 (type species *Antipathes glaberrima* Esper, 1792:160, pl. 9); Gray, 1857a:113; Gray, 1857b:273; Brook, 1889:95; Roule, 1905:73; Gravier, 1918:225.
Antipathes (in part), van Pesch, 1914:76; Pax, 1918:470.

Diagnosis

Corallum irregularly sympodial; branching multi-directional or flabellate. Branchlets arranged irregularly; loosely bilateral or uniserial; pinnules not present. Spines poorly developed; small, simple, smooth surfaced; conical, deltoid, or hemispherical in shape; reduced in size or absent on larger branches and stem. Polyps very variable in size and spacing; equally wide in sagittal and transverse diameters, or slightly longer along sagittal axis; uniserially arranged on smallest branches, irregularly distributed on all sides of axis on larger branches and stem.

Discussion

The type species of the genus is *Leiopathes glaberrima* (Esper, 1792). Esper's original specimen still exists in the Erlangen Museum in Germany, but was not available for study.

The genus name *Leiopathes* was first used by Gray in 1840 in a listing of the collections of the British Museum; however, the name was not accompanied by a description, illustration, or reference to a previously described species; therefore, it must be considered a nomen nudum. The name appears in subsequent editions of the Synopsis of the British Museum, but also without

a designated type species (Gray 1842). There is no evidence that Gray published a detailed description of *Leiopathes* until 1857. However, in 1849, in a publication describing a species he identified as *Leiopathes lamarcki*, Haime specifically stated that the type of *Leiopathes* was Esper's species *Antipathes glaberrima*. Even though he himself referred to *Leiopathes* as Gray's genus, Haime has to be considered the author of the genus.

In 1857 Gray reported that the species he had previously described in 1832 (as *Antipathes dichotoma*, Pallas) 'has been separated from others in the genus because the surface of the axis is smooth and not covered with a number of minute, uniform cylindrical spines like the true *Antipathes*' (Gray 1857a). In another paper appearing in the same year, Gray (1857b) defines the genus as follows: 'Axis smooth, polished, branched, forked. Bark soft, deciduous, deliquescent, sometimes forming (when dry) smooth, transparent masses at the fork of the branches'. It is in this second publication that Gray placed *Antipathes glaberrima* Esper in the genus *Leiopathes*, and he also indicated (in the synonymy) that *Antipathes dichotoma* Pallas was possibly identical to *L. glaberrima*. According to Brook, Lacaze Duthiers (1864, 1865) was the first investigator to observe that *L. glaberrima* possessed axial spines, and even though these spines are noticeable only on the smallest branches and branchlets, their presence essentially eliminated the primary character used by Gray. In 1889 Brook reported that the polyps of *L. glaberrima* possessed 12 complete mesenteries, not ten as in other species of the genus *Antipathes*, and for this reason he advocated that the genus be maintained. Therefore, *Leiopathes* is currently recognized not by the diagnostic characters given by Gray, but by the secondary description given by Brook. The illustration of *A. glaberrima* given by Esper (1792) indicates that the type is devoid of polyp tissue; therefore, it lacks the key diagnostic feature of the genus. Under such circumstances it would be appropriate to treat Brook's specimen as a substitute type specimen.

1. ***Leiopathes secunda*** sp. nov.
(Figs 1–3)

Diagnosis

Corallum branched irregularly, sympodial and flabellate to varying degrees; height 25 cm or more, with 30 or more orders of branching. Stem appearing crooked or sinuous. Smallest branchlets 5–10 mm long; commonly arranged uniserially, mostly 2–4 mm apart, on convex side of curved lower order branches; usually curved upward toward distal part of branch from which they arise. Groups of small branches and branchlets arranged in unilateral scorpioid cymes.

Spines simple, smooth, and conical with rounded or slightly acute apex; subequal or slightly unequal around axis circumference; typically 0.06–0.08 mm, but up to 0.12 mm, from midpoint of base to apex; and arranged in axial rows, generally with 5–6 spines per millimetre in each row. Spines present on stem; 0.06 mm tall.

Polyps very variable in size, up to 1 mm in transverse diameter (from proximal side of proximal lateral tentacles to distal side of distal lateral tentacles) and spaced up to 0.8 mm apart. Polyps on smallest branchlets arranged uniserially, usually with 6–8 polyps per centimetre.

Description of Holotype

The holotype (SAM H-756) is approximately 26 cm high and about 20 cm wide (Fig. 1), and the diameter of stem just above the basal end is 2.5 x 4.0 mm. The corallum is branched to the 30th order or more, with the higher order branches often becoming more developed than the branch from which they originate. As a result of this laxly sympodial branching, the stem and major branches have a crooked or sinuous appearance. Very few of the branches are longer than 5 cm and these often have 3–4 higher orders of branches. The branchlets (Fig. 2a) are often arranged uniserially, with up to 9 or more along a section of branch about 3 cm long. They usually occur on the convex side of the lower order branches; generally spaced 2–4 mm apart, with 3–4 branchlets per centimetre. The distal angle of the branchlets ranges from 60 to 90°, but most are close to 90°. Although a few of the branchlets are straight, most are curved toward the distal part of the branch from which they arise. Most of the largest unbranched branchlets on the corallum are 5–7 mm in length and 0.14–0.16 mm in diameter near their base (excluding spines); a few are as long 1.0 cm.

The spines on the branchlets (Fig. 3b) are generally 0.06–0.08 mm tall, as measured from middle of base to apex; a few are as large as 0.1 mm. They are simple, smooth and conical, and have a rounded or acute apex. The spines are equal or slightly unequal in size around the circumference of the axis. They are arranged in axial rows, 3–4 of which can be seen from one

FIGURE 1. *Leiopathes secunda* sp. nov., holotype, SAM H-756, entire corallum, height about 26 cm.

aspect (includes only those rows in which the base of the spines are visible), and within each row they are spaced 0.18–0.30 mm apart, resulting in 5–6 spines per millimetre in each row. At the tips of the branchlets the spines are relatively narrow with a more rounded apex, and the branchlet itself may be flanged with the spines occurring along ridges separated by shallow grooves (Fig. 3a). Spines are also present on the larger branches (Fig. 3c) and stem where they reach a maximum size of about 0.06 mm.

The polyps on the branchlets and higher-order branches are arranged somewhat uniserially, often on the convex or lateral side of the branchlets (Fig. 2b). In general, they tend to face out of one side of the corallum. Polyp size is very variable, but the largest polyps are usually not more than 0.8 mm in transverse diameter as measured from proximal side of proximal lateral tentacles to distal side of distal lateral tentacles. The interpolypar space is variable in width, up to about 0.8 mm. On average, there are 6–8 polyps per centimetre.

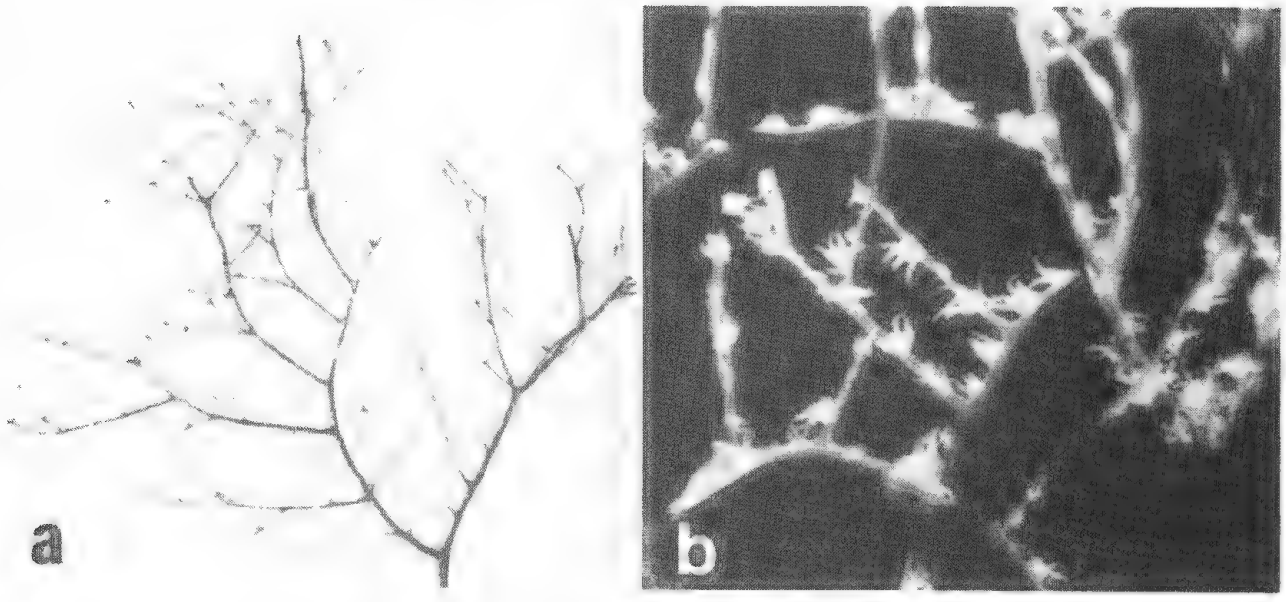

FIGURE 2. *Leiopathes secunda* sp. nov., holotype, SAM H-756; **(a)** outer edge of corallum showing the arrangement of the branchlets; **(b)** branchlets with polyps, approx. x 4.

Although the larger branches and stem are mostly denuded of soft tissues, where they are present, the polyps appear to be distributed on all sides of the axis.

Discussion

The paratypes are all small colonies; however, they each exhibit in varying degrees the distinctive uniserial branching pattern seen in the holotype. As in the holotype, the ultimate branchlets in these colonies are closely spaced and usually not more than 1 cm long. In one of the paratypes (SAM H-757) the spines on the branchlets attain a maximum size of 0.12 mm; in the others the

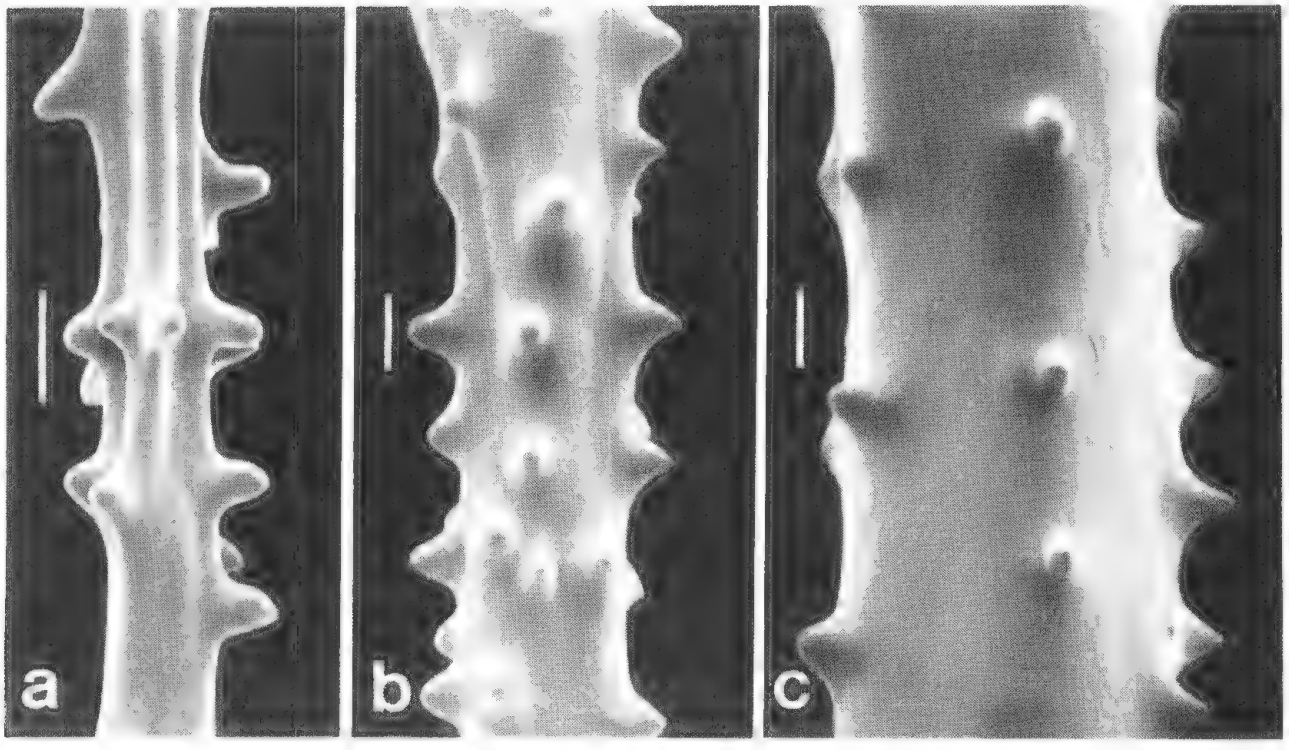

FIGURE 3. *Leiopathes secunda* sp. nov., holotype, SAM H-756; **(a)** Spines near tip of branchlet, **(b)** spines on branchlet 0.25 mm in diameter, **(c)** spines on branch 0.45 mm in diameter. Scale bars 0.1 mm.

largest spines are 0.06–0.08 mm. Slight variations occur among the specimens in the density and number of rows of spines (e.g., 3.5–7 spines per millimetre and 2–5 rows visible from one aspect), but such variability is likely to be observed even in a single specimen. Polyps in these specimens are usually 1 mm or less in transverse diameter. Although the interpolypar space is quite variable, there are generally 6–8 polyps per centimetre, as in the holotype.

Comparisons

In general appearance *Leiopathes secunda* sp. nov. resembles *L. expansa* Johnson, 1899 and *L. grimaldii* Roule, 1905. In both *L. expansa* and *L. grimaldii* the higher order branchlets are arranged uniserially on the convex side of the curved lower order branches, as in *L. secunda*. However, in *L. secunda* the branching is not as distinctly flabellate as in the other two species. Furthermore, the spines of *L. secunda* are slightly larger and more crowded than those of the other two species. Johnson (1899) described the spines of *L. expansa* as being minute, upright conico-subdeltoid, and irregularly scattered on the ultimate branchlets but absent on other parts of the corallum. As estimated from the illustration, the spines of *L. expansa* appear to be 0.05–0.06 mm tall and 0.5–0.6 mm apart on a branchlet 0.23 mm in diameter. In contrast, the spines of *L. secunda* are consistently 0.06–0.08 mm tall, with some reaching a size of 0.12 mm, and they are typically 0.14–0.30 mm apart. In addition, in *L. secunda* spines are also found on the largest branches and on the stem, whereas this is not the case in *L. expansa*. Roule (1905) does not mention the size of the spines of *L. grimaldii*, nor are any illustrations provided; however, he does note that they are only present on the smallest branchlets, i.e., branchlets measuring 0.2–0.3 mm in diameter.

Roule (1905) reported that the polyps of *L. grimaldii* are 0.5–1.0 mm in diameter and spaced 0.8–1.6 mm apart. The size and spacing of the polyps of *L. secunda* are similar. The polyps of *L. expansa* were not described by Johnson (1899) except for the statement that the specimen was a light red in color. Roule reported that the polyps and coensarc of *L. grimaldii* were red-yellow. The color of *L. secunda* was not recorded.

Etymology

From the Latin '*secunda*' (in a row) in reference to the uniserial arrangement of the branchlets.

Material Examined

Holotype. **Tasmania**: Cascade Plateau, about 160 nautical miles east of South East Cape, 44°00'S, 150°28'E, 760–910 m, F/V 'Labrador', 10 February 1990, K. Gowlett-Holmes (SAM H 756; schizoholotype, USNM 99407).

Paratypes. **Tasmania**: Cascade Plateau, about 160 nautical miles east of South East Cape, 43°58'S, 150°22'E, 890–900 m, F/V 'Labrador', 11 February 1990, K. Gowlett-Holmes (SAM H 757; schizoparatype, USNM 99404).—Cascade Plateau, about 155 Nm east of South East Cape, 43°58'S, 150°22'E, 1000 m, F/V 'Labrador', 9 February 1990, K. Gowlett-Holmes (SAM H 755; schizoparatype, USNM 99406).—Cascade Plateau, about 165 Nm east of South East Cape, 44°03'S, 150°26'E, 1100 m, F/V 'Labrador', 16 February 1990, K. Gowlett-Holmes (SAM H 758; schizoparatype, USNM 99398).

Distribution

Known only from the waters off Tasmania at depths of 760–1100 m.

2. ***Leiopathes acanthophora*** sp. nov.
(Figs 4–6)

Diagnosis

Corallum branched irregularly, but with some branches and branchlets uniplanar. Branchlets arising from all sides of lower order branches, but occasionally uniserial over short distances. Highest order, unbranched branchlets typically 1.5–2.5 cm long, 0.2–0.3 mm in diameter and spaced 5–7 mm apart.

Spines conical, acute, smooth, and subequal or slightly unequal. Spines on branchlets typically 0.10–0.14 mm from midpoint of base to apex. Spines on branchlets spaced 0.4–0.9 mm apart (2–3 per millimetre) and arranged in axial rows, 3–4 of which seen from one aspect. Spines present on larger branches and stem.

Polyps variable in size, 0.6–2.0 mm in transverse diameter and spaced 0.4–1.8 mm apart. Polyps on smallest branchlets arranged uniserially, with 4–6 polyps per centimetre. Polyps on larger branches occurring irregularly on all sides of axis.

Description of Holotype

The holotype (SAM H 906) consists of numerous broken pieces, one of which is about 30 cm tall (Fig. 4) and has a basal 'stem' diameter of about 5 mm. The largest simple branchlets (those on the outer edges of the corallum, Fig. 5a) are

FIGURE 4. *Leiopathes acanthophora* sp. nov., holotype, SAM H-908, entire corallum, height about 30 cm

usually 1.5–2.5 cm long although some are as much as 4 cm long and 0.3 mm in diameter at their base. Branchlets are placed at very varying intervals, most commonly they are 5–7 mm apart, with 2–3 branchlets per centimetre. The distal branch angle is usually 90° or slightly less, and the terminal branchlets are straight or slightly curved.

The axial spines are 0.10–0.14 mm, as measured from the middle of the base to apex. They are simple, smooth, and conical, with a slightly rounded to acute apex. Those on the smallest branchlets (Fig. 6a) are relatively narrow with a rounded apex. On the larger branchlets they become more conical or deltoid (Fig. 6b). They measure 0.12 mm on a branch 0.8 mm in diameter (Fig. 6c), and 0.1 mm on a stem-like branch 4 mm in diameter. In places the size of the spines varies slightly (0.001–0.003 mm) around the circumference of the axis; however, the largest spines are not always associated with the polyp side of the axis. On the branchlets the spines are

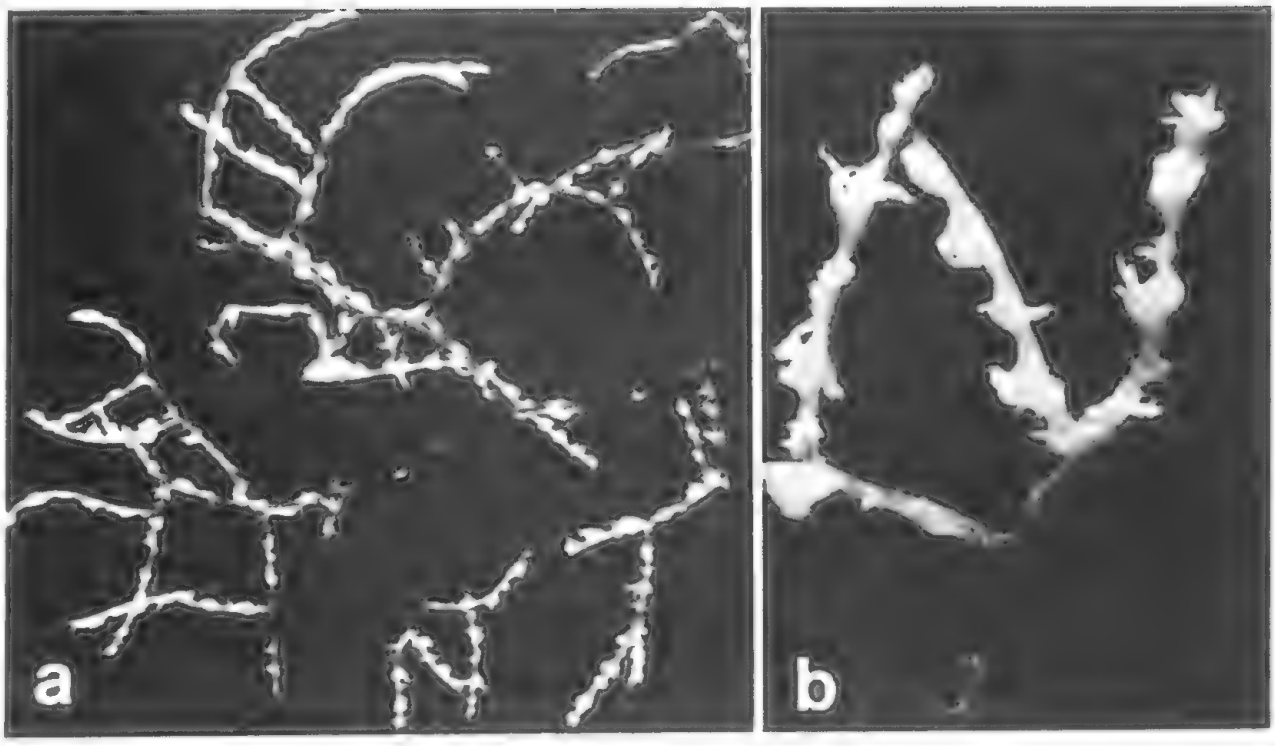

FIGURE 5. *Leiopathes acanthophora* sp. nov., holotype, SAM H-906; **(a)** outer edge of corallum showing arrangement of branchlets, **(b)** branchlets with polyps, approx. x 4.

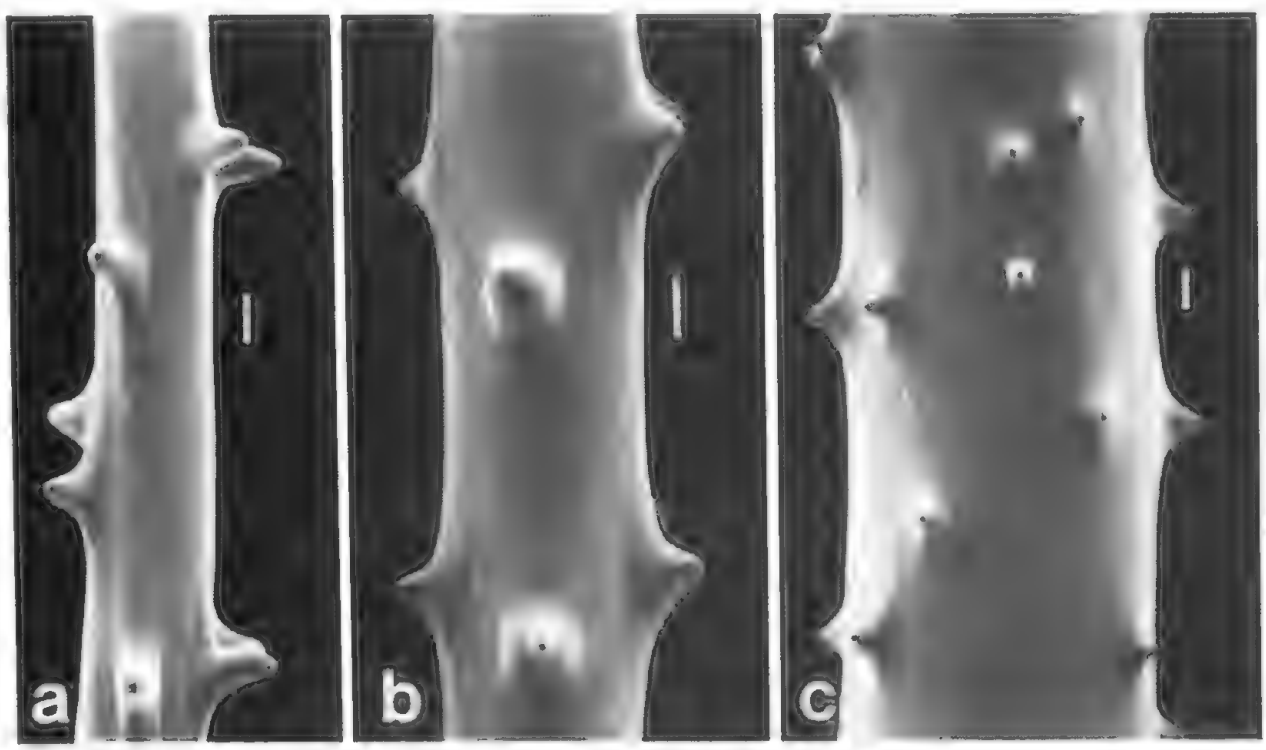

FIGURE 6. *Leiopathes acanthophora* sp. nov., holotype, SAM H-906; **(a)** Spines near tip of branchlet, 0.25 mm in diameter, **(b)** spines on branchlet 0.35 mm in diameter, **(c)** spines on branch 0.84 mm in diameter. Scale bars 0.1 mm.

arranged in axial rows, 3–4 of which can be seen from one aspect (includes only those rows in which the bases of the spines are visible); and within each row they are spaced 0.4–0.9 mm apart, resulting in 2–3 spines per millimetre. On the largest branches the spines tend to become flared out distally and proximally, and they are less regularly arranged in axial rows.

In general, the polyps are arranged uniserially (Figs 5a,b), although on the larger branches they occur irregularly on all sides of the axis. The size of individual polyps is quite variable, and small polyps are often present between the largest ones. In terms of transverse diameter, polyp size ranges from 0.6 to 2.0 mm (measured from proximal side of proximal lateral tentacles to the distal side of distal lateral tentacles). The interpolyp space is also quite variable, ranging from 0.4 to 1.8 mm; consequently, there can be as few as 4 to as many as 6 polyps per centimetre. In the alcohol-preserved material, the polyp tentacles measure 1.6–2.8 mm.

Comparisons

The branching pattern of *Leiopathes acanthophora* sp. nov. is similar to that of *L. glaberrima* (Esper, 1792). Both species have relatively long irregularly arranged branchlets. Based on descriptions given in the literature, it appears that the branchlets in *L. glaberrima* are thicker than those in *L. acanthophora*. Brook (1889) reported that the terminal branchlets in *L. glaberrima* were 0.5–0.7 mm in diameter, while those in *L. acanthophora* are only 0.2–0.3 mm. In addition, the spines of *L. acanthophora* are considerably larger than those in *L. glaberrima*. Based on the illustration given by Brook (1889), the spines in *L. glaberrima* measure 0.04–0.06 mm. In comparison, those in *L. acanthophora* are usually 0.10–14 mm. Furthermore, in *L. glaberrima* the largest branches are devoid of spines, but this is not the case in *L. acanthophora*. Brook (1889) also reported that the polyps in his specimen of *L. glaberrima* were about 1.0 mm in diameter. Although the polyps in *L. acanthophora* are quite variable in size, some are as much as 2 mm in diameter. These differences are sufficient to adequately differentiate the two species.

Etymology

From the Latin '*acantho*' (spine) and '*phora*' (bearing) in reference to the fact that this species has larger and more numerous spines than the closely related *L. glaberrima*.

Material Examined

Holotype. **Indian Ocean**: about 125 Nm east of Cape Arid, W. Australia, 34°03'S, 125°31'E, 1011–1020 m, F/V 'Adelaide-Pearle', 31 July 1988, K. Gowlett-Holmes, K. Olsson and M. Cameron (SAM H 906; schizoholotype, USNM 99402).

Distribution

Known only from off the coast of Western Australia, at a depth of 1011–1020 m.

3. ***Leiopathes bullosa*** sp. nov.
(Figs 7–9)

Diagnosis

Corallum branched irregularly, but with groups of branchlets tending to be uniplanar. Highest order, unbranched branchlets straight or curved slightly; up to 2 cm long, 0.2 mm in diameter and spaced 0.5–1.5 cm apart; with 1–3 branchlets per centimetre.

Spines typically hemispherical, blister-like; up to 0.14 mm from midpoint of base to apex, subequal or slightly unequal in size around the axis. Spines arranged in rows, commonly spaced 0.4–0.6 mm apart in each row, with 2.5–3.5 spines per millimetre. Spines absent on larger branches and stem.

Polyps 0.7–2.0 mm in transverse diameter, spaced 0.6–2.5 mm apart, with 3–5 per centimetre.

Description of Holotype

The holotype (SAM H-754) consists of a number of broken branches. One such piece is shown in Figure 7. The branching pattern is rather loose and open and generally does not follow any specific pattern, although on several branches the branchlets tend to be unilateral or bilateral, and the branching tends to be spread out in a single plane. The largest simple branchlets (those without secondary branching and usually located on the outer edges of the larger branches) are mostly 0.5–1.5 cm long and 0.10–0.15 mm in basal diameter (excluding spines); however, a few are as long as 2 cm and 0.2 mm thick. Branchlets are placed at very varying intervals, mostly 5–7 mm apart but up to 1.5 cm apart, usually with 2–3 branchlets per centimetre, but sometimes with only 1 per centimetre. The branchlets are inserted mostly at right angles (distal angle ~90°); they are usually straight or only slightly curved or sinuous (Fig. 8a).

FIGURE 7. *Leiopathes bullosa* sp. nov., piece of holotype, SAM H-754.

The spines are typically hemispherical and blister-like (Figs. 9c–d); although on the smaller branchlets they are more knob-like (Fig. 9b) and the axis can be fluted with the spines occurring along the edges of the ridges (Fig. 9a). The branchlet spines are very variable in size, 0.07–0.14 mm, as measured from middle of base to apex. They are subequal or slightly unequal in size with up to a 0.04 mm difference on opposite sides of the axis; the largest spines, however, are not consistently associated with the polyp side of the axis. The spines are arranged in axial rows, 3–4 of which can be seen from one aspect (includes only those rows in which the base of the spines are visible), and within each row they are spaced 0.2–0.7 mm apart (usually 0.4–0.6 mm). On average,

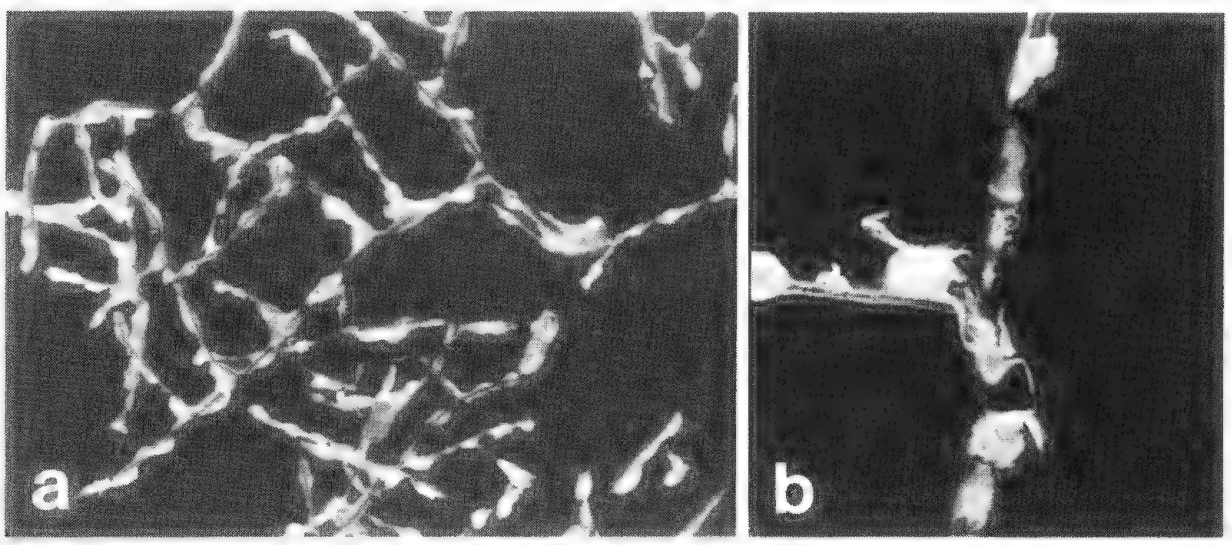

FIGURE 8. *Leiopathes bullosa* sp. nov., holotype, SAM H-754; **(a)** outer edge of corallum showing arrangement of branchlets, **(b)** branchlet with polyps, approx. x 3.5.

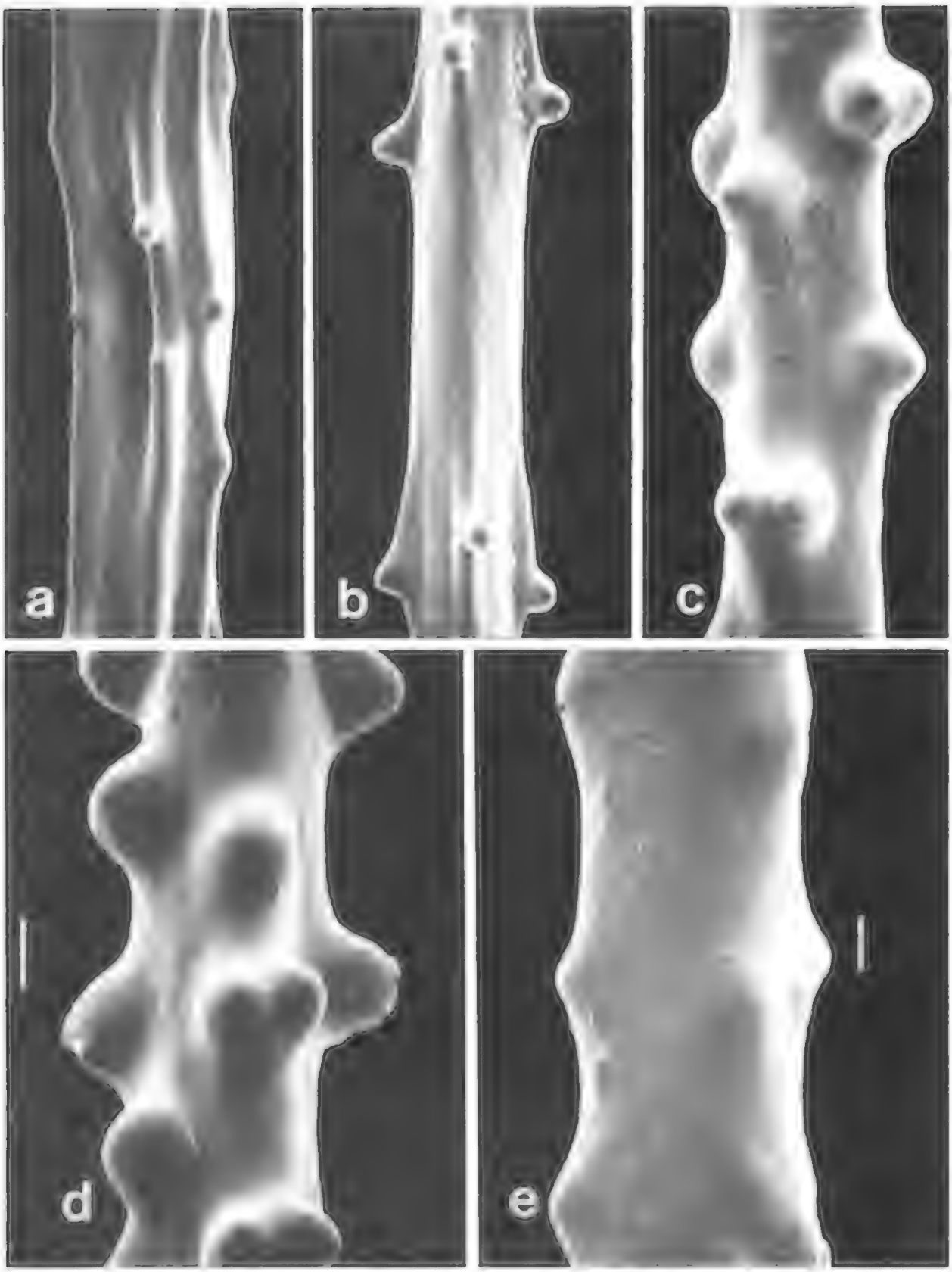

FIGURE 9. *Leiopathes bullosa* sp. nov., holotype, SAM H-754. (a) Spines on branchlet 0.2 mm in diameter. (b) spines near distal end of branchlet 0.15 mm in diameter. (c) spines on branchlet 0.28 mm in diameter. (d) spines on branchlet 0.27 mm in diameter. (e) branch 0.4 mm in diameter. Scale bars 0.1 mm; magnification in a and b as in d, in c as in e.

there are 2.5–3.5 spines per millimetre in each row. In places the spines can be seen to be undergoing longitudinal fission. On the larger branchlets and smallest branches the spines become wide and flattened, and on branches larger than 0.4–0.5 mm in diameter they are absent. However, the transition from hemispherical spines to no spines occurs in a very narrow and overlapping range of branch diameters, and sometimes smaller diameter branches may be smooth and larger ones spinous.

The polyps on the holotype are in a poor state of preservation (Fig. 8). They appear to be arranged uniserially on the branchlets and very irregularly on the largest branches. They are mostly 1.6–2.0 mm in transverse diameter as measured from proximal side of proximal lateral tentacles to distal side of distal lateral tentacles, but some are as small as 0.07 mm. The width of the interpolyp space is also variable, ranging from 0.6 to 2.5 mm. There appears to be 3–5 polyps per centimetre on the branchlets. The maximum length of the tentacles in the alcohol-preserved material is about 2.5 mm. The polyps were reported to be red in color when the specimen was collected.

Discussion

Leiopathes bullosa is unique among species of *Leiopathes*, as well as among other known species of antipatharians, in having hemispherical, blister-shaped spines. The development of a grooved and ridged axis on some of the smallest branchlets, which is also seen occasionally in *L. secunda* is an unusual feature resembling a similar structure present on the stems of certain species of *Bathypathes*.

Comparisons

In basic pattern of branching *Leiopathes bullosa* resembles *L. acanthophora* sp. nov. and *L. glaberrima* (Esper, 1792); however, the species can be differentiated by the size and shape of the spines which are very distinctly hemispherical in *L. bullosa* but deltoid in *L. glaberrima* and *L. acanthophora*. Although poorly preserved, the polyps on the type specimen of *L. bullosa* appear to be as large as those in *L. acanthophora*.

Etymology

From the Latin '*bullosa*' (covered with swellings) in reference to general appearance of the axis caused by the blister-like spines.

Material Examined

Holotype. **South Australia**: Great Australian Bight, about 120 Nm southwest of Cape Adieu, 33°29'S, 130°33'E, 520–560 m, F/V 'Longva', 14 April 1990, K. Gowlett-Holmes (SAM H-754; schizoholotype, USNM 99409).

Distribution

Only known from the Great Australian Bight, from a depth of 522–560 m.

Acknowledgments

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POOLWANNA : A (H5) CHONDRITE FROM THE SIMPSON DESERT OF SOUTH AUSTRALIA

M. ZBIK & A. PRING

Summary

The Poolwanna meteorite is a single stone weighing 0.875 kg and was found some 70 km west of the southern end of Lake Poolwanna in north eastern South Australia. It consists of olivine ($Fa_{17.1\pm0.25}$, n=30), low-Ca pyroxene ($Fs_{17.6\pm1.7}$ $Wo_{0.7\pm0.8}$, n=25), and plagioclase feldspar. Based on texture and mineral chemistry, Poolowanna is classified as a H5 chondrite of shock stage S3-4.

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M. Zbik[1] & A. Pring[2], [1] Ian Wark Research Institute, University of South Australia, The Levels, Adelaide, South Australia 5095, [2] Department of Earth Sciences, South Australian Museum, North Terrace, Adelaide, South Australia 5000. Manuscript received 11 April 1998.

The meteorite was found in May 1997 by Mr Roger Henwood of Woomera, South Australia, during an expedition to the Simpson Desert to recover parts of the Blue-Streak Rocket which was launched from Woomera in 1966. Mr Henwood reported that he found the stone on the top portion of a wide sand dune in the Simpson Desert at a locality some 70 km west of the southern end of Poolowanna Lake, in northern South Australia. The locality is on the Poolowanna 1:250000 map sheet and the site was recorded using a GPS monitor (lat 26° 49.896'S, long 136° 51.523'E) (Figure 1). Given that there are few geographical place names in the Simpson desert we propose the name Poolowanna for the meteorite and should further meteorites be found in this map sheet area they be numbered sequentially. Mr Henwood surrendered the meteorite to the Museum in accordance with the South Australian Meteorite Act and was given a cash reward and presented with a bronze medallion to commemorate the find.

Macroscopic And Microscopic Description

The meteorite is 0.875 kg single stone, of rounded rectangular shape, measuring 12 x 9 x 4 cm, with a weathered brown fusion crust and a number of deep weathering cracks. The distinctive fusion crust is 1 to 2 mm thick and dark brown in colour due to the staining of iron oxide and hydroxide minerals. The silicate minerals throughout the meteorite are also stained by iron oxides and hydroxides, indicating that it had been exposed to the weather for many years. The fusion crust surface is broken by numerous fractures which have been filled with iron oxides and quartz grains.

In thin section, the meteorite is medium to fine-grained and generally stained brown by iron oxides. The chondrule boundaries are generally clearly visible but in areas of fracture and weathering the boundaries are sometimes obscured. The chondrules are typically between 0.5 and 1 mm in diameter but some of more than 2 mm in diameter were also noted. Metal and troilite have been partially oxidized and occur as disseminated grains (0.01–2.0 mm in longest dimension) throughout the matrix.

Sampling And Analytical Procedures

Polished thin sections were prepared from meteorite slices and were used for petrographic examination and microprobe analyses. Compositions of the silicate minerals were determined using a CAMECA SX51 electron microprobe with a Moran analysis package at the University of Adelaide Centre for Electron Microscopy and Microstructure Analysis. Analyses were made using an accelerating voltage of 15 kV, a sample current of 20 nA, and beam width of 5 μm.

Mineralogy

In the meteorite there are two groups of chondrules: those less than 1 mm in diameter are

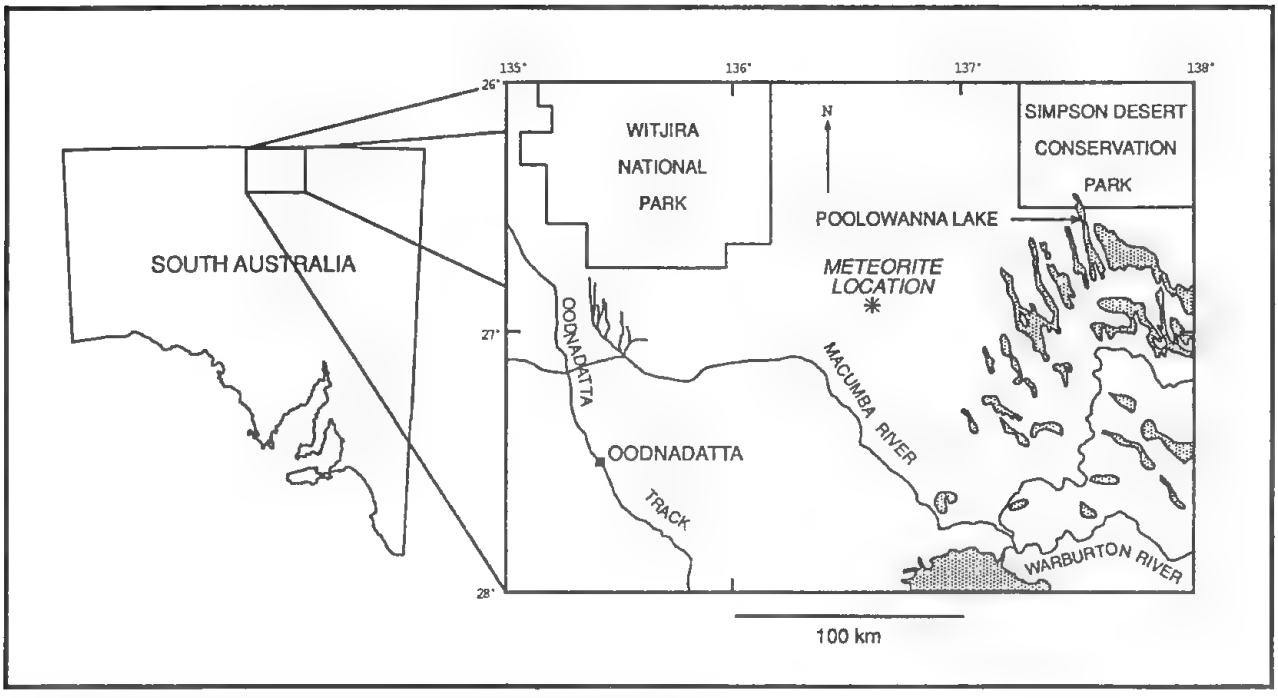

FIGURE 1. Map showing the location of the Poolowanna meteorite.

spherical while those larger are much less regular in shape. The chondrules and chondrule fragments are composed predominantly of recrystallised olivine and orthopyroxene and display microcrystalline texture. The chondrules can be classified according to the system of Wasson (1993). Barred olivine chondrules (BO) are rare and composed of olivine with pyroxene-plagioclase mesostasis between the olivine bars. There are a number of microcrystalline pyroxene chondrules (C) which range in size from a fraction of a millimetre to about 2 mm, and exhibit strong undulose extinction. Radial pyroxene chondrules (RP) are common, and display a range of crystal sizes but nucleation appears to have occurred at a single point on the rim of the chondrules. Several unusual chondrules, containing large radial pyroxene crystals coexisting with porphyritic olivine grains, were noted in Poolowanna. This type of chondrule is not included in Wasson's (1993) classification. A number of granular olivine-pyroxene chondrules (GOP), porphyritic pyroxene (PP) and pyroxene-olivine (POP) chondrules are also present. The latter contain fine and coarse, euhedral olivine grains and have a poikilitic texture with turbid microcrystalline plagioclase mesostasis between olivine and pyroxene crystals.

Olivine in the Poolowanna meteorite is equilibrated with a mean fayalite content of $Fa_{17.1\pm0.25}$, n=30. The orthopyroxene shows a limited variation in composition with a mean ferrosilite content of $Fs_{17.6\pm1.7}$, n=25 and a wollastonite content of 0.7 mol% ±0.8. Clinopyroxene has not been detected and the interstitial plagioclase is partially converted to maskelynite, and due to the heavy weathering of the meteorite its composition is variable and not original.

A number of quartz grains, almost certainly of aeolian origin, are incorporated into the weathered crust and introduced into the meteorite interior along fracture veins.

Classification

The Poolowanna meteorite is classified as an H5 chondrite. The olivine ($Fa_{17.1}$) and orthopyroxene ($Fs_{17.6\pm1.7}$) compositions are within the range of the H chondrites (Keil & Fredriksson 1964). The equilibrated mineral compositions, crystalline matrix, well-defined chondrule boundaries and recrystallised plagioclase, suggest that Poolowanna meteorite belongs to the type 5 classification of Van Schmus and Wood (1967). The wollastonite content in the orthopyroxene is similar to that found in other H5 chondrites (Scott *et al.*, 1986).

Pyroxene crystals in the Poolowanna chondrite

display weak planar fractures and weak mosaicism which all indicate that the meteorite seems to be only slightly shocked after metamorphism. According to the classification scheme of Stöffler *et al.* (1991), the shock facies is estimated to be S3–4; weakly to moderately shocked.

Acknowledgments

The authors wish to thank Mr Roger Henwood for bringing the meteorite to the Museum's attention, and Mr John Terrlet of CEMMA, University of Adelaide for assistance with electron microprobe analysis. We thank Dr Alex Bevan of the Western Australian Museum for his constructive review of this paper.

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CONFIRMATION OF THE ASSOCIATION OF THE HYPERIIDEAN AMPHIPOD GENUS HYPERIA (CRUSTACEA : AMPHIPODIA: HYPERIIDEA: HYPERIIDAE) WITH CTENOPHORES

WOLFGANG ZEIDLER

Summary

In July 1993 several specimens of ctenophore (Beroe sp.) were observed in Port Phillip Bay, Victoria with a crustacean associate. One animal was collected and the associate removed and identified as the hyperiidean amphipod, Hyperia gaudichaudii Milne Edwards, 1840.

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In July 1993 several specimens of ctenophore (*Beroe* sp.) were observed in Port Phillip Bay, Victoria with a crustacean associate. One animal was collected and the associate removed and identified as the hyperiidean amphipod, *Hyperia gaudichaudii* Milne Edwards, 1840.

Species of *Hyperia* have been recorded in association with ctenophores of the genus *Beroe* in the literature previously (Thurston 1977) but Laval (1980) suspects that these records may actually be of *Hyperoche*, as young *Hyperoche* may have been confused with *Hyperia*. This would seem to be a reasonable assumption as *Hyperoche* is a well known associate of medusae and ctenophores (Flores & Brusca 1975, Harbison *et al.* 1977, Laval 1980) and some genera, and even families of hyperiideans, appear to be restricted to certain host groups (Laval 1980). Martin and Kuck (1991), in recording *Hyperia medusarum* from the giant scyphozoan, *Chrysaora achlyos* (see Martin *et al.* 1997), conclude that 'it is likely that species of *Hyperia* occur only on scyphozoan and hydrozoan medusae (Pasko 1987)'.

The present observation is based on only one collected animal although others were observed in the field by one of us (K. L. G-H). It was hoped that more material would be forthcoming but this has not occurred. Never-the-less, the association of *Hyperia* with ctenophores has now been confirmed and previous literature records of such associations should not be dismissed. *Hyperia galba* (Montague, 1815) has been recorded from *Beroe* by Stephensen (1923), Schellenberg (1942), Buchholz (1953) and Oldevig (1959) and *H. gaudichaudii* has been recorded from a large *Beroe* sp. from the Falkland Islands by Stebbing (1914).

Material examined

Host. *Beroe* sp. (SAM H912) approx. 40x25mm, from off Portsea, Port Phillip Bay, Victoria, drifting with current, 1–3m. Collected by K. L. Gowlett-Holmes, 5th July 1993. Photo index PH 0082, 3 colour slides.

Associate. *Hyperia gaudichaudii*, female 8.5mm with enlarged oostegites and eggs not yet released into brood pouch, with reddish pigment spots all over except for eyes and extremities of uropoda (SAM C5831). Photo index PC 0064 (same three slides as PH 0082).

The *Beroe* and its associate were transported alive to the South Australian Museum for observation.

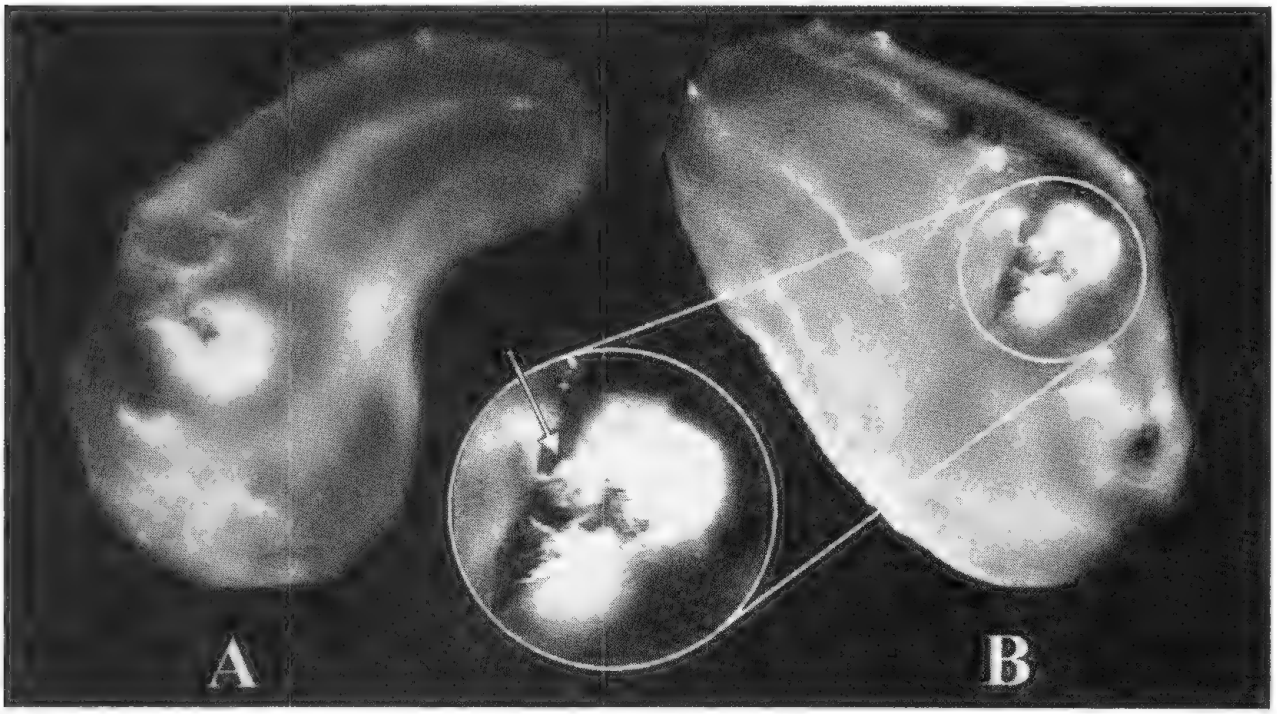

FIGURE 1. Two aspects of the *Beroe* from Port Phillip Bay showing the hyperiidean associate *Hyperia gaudichaudii*. The specimen on the right in **B** appears to be a male judging by the relatively long antennae (arrowed).

Field observations and location within host

Several *Beroe* (approx. 15) were observed in the field and at least half had hyperiidean associates. Generally two hyperiideans were observed together on each host, occupying the same cavity. When disturbed they became agitated and sometimes the smaller one or more slender specimen would flee. It is presumed that these were mating pairs and that it was the male, being 'free swimming,' that fled. When the specimen of *Beroe* being photographed was collected, one of the hyperiideans escaped. An examination of the slides taken of this animal (Fig. 1) revealed that one of the hyperiideans has relatively long antennae (Fig. 1B), confirming that it was a male that had escaped.

For the specimen collected, the female *Hyperia* was found in a small cavity along one of the comb rows (presumably created by the female) and was positioned upside down holding onto the *Beroe* tissues with pereopods 6 and 7. At the base of the cavity a flap of *Beroe* tissue separated the amphipod from a tunnel which went all the way through to the gastrovascular cavity, indicating that the amphipod either ventured to the gastrovascular cavity to feed or intended to provide access for her future offspring. Above this cavity, on the same comb row, an old scar with cilia missing indicated possible feeding. Similarly, on the comb row either side, shallow cavities with cilia missing suggest recent feeding or burrowing activities. It is also possible that these scars were made by other hyperiideans attempting to invade the same host but their proximity to the main cavity would suggest that the damage was made by the resident associate.

The kind of burrowing observed here, resulting in the combination of a cavity, tissue flap and tunnel to the gastrovascular cavity, has not been recorded previously for any other hyperiidean-gelatinous plankton association.

Actual feeding by the female *Hyperia* was not seen.

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OBITUARY MEREDITH JOAN SMITH 10 FEBRUARY, 1943 – 18 JULY 1998

GRAHAM C. MEDLIN

Summary

Friends and colleagues were shocked by the sudden death, on 18 July 1998, of Dr Meredith Smith, aged 55 years, Senior Scientist in the Evolutionary Biology Unit of the South Australian Museum. Meredith had been on her first overseas holiday, on safari in Kenya, when three weeks into her trip she became ill. Tests in the hospital in Nairobi indicated that she had a very low haemoglobin count and after a blood transfusion Meredith returned to Australia with her eldest daughter Felicity. After further tests at the Royal Adelaide Hospital she was diagnosed with lymphoma. During a course of chemotherapy, Meredith died suddenly, two weeks after she had returned to Adelaide.

OBITUARY

MEREDITH JOAN SMITH

10 February 1943 – 18 July 1998

Friends and colleagues were shocked by the sudden death, on the 18 July 1998, of Dr Meredith Smith, aged 55 years, Senior Scientist in the Evolutionary Biology Unit of the South Australian Museum. Meredith had been on her first overseas holiday, on safari in Kenya, when three weeks into her trip she became ill. Tests in the hospital in Nairobi indicated that she had a very low haemoglobin count and after a blood transfusion Meredith returned to Australia with her eldest daughter Felicity. After further tests at the Royal Adelaide Hospital she was diagnosed with lymphoma. During a course of chemotherapy, Meredith died suddenly, two weeks after she had returned to Adelaide.

Born Meredith Joan Clark on 10 February, 1943, she attended the Magill Primary School and Norwood High School before entering the University of Adelaide in 1960. As a young woman, Meredith had wanted to become a vet, but this was not possible in South Australia so she chose zoology instead, gaining a First Class

Honours Degree in 1963. After working for two years with the CSIRO in Canberra, Meredith returned to Adelaide and completed a PhD thesis (Smith 1969) on the subject 'A study of the embryonic quiescence in diprotodont marsupials'. The excellence of her scientific work was recognised early in her career when, in 1968, she received the Bolliger Award from the Australian Mammal Society, for a paper titled 'Artificial termination of embryonic diapause in the red kangaroo and the tammar wallaby'.

While the intricacies of marsupial reproduction remained Meredith's scientific passion throughout her life, she somehow found the time to study fossil vertebrates from the Victoria Cave at Naracoorte, subfossil vertebrates from the Flinders Ranges as well as freshwater shrimps found in South Australian inland waters. Her early work focused on the reproduction of possums (Petauridae, Phalangeridae and Burramyidae) and kangaroos (Macropodidae), but later this was to change to the smaller rat-kangaroos (Potoroidae) and in particular the reproductive biology of the brush-tailed bettong *Bettongia penicillata*, which she was still studying just prior to her death.

In the early 1970s Meredith worked on the identification of small fossil vertebrates from Victoria Cave near Naracoorte in the South East of South Australia and became an acknowledged expert on the identification of a wide range of small vertebrates. From 1971 to 1976 she published five papers on the Naracoorte cave fauna with topics as diverse as the skull and dental characteristics of fossil Potoroidae, Petauridae, Burramyidae, Peramelidae, Thylacinidae, and Dasyuridae, to the identification of fossil birds and reptiles. Two papers concentrated on the identification of elapid snakes and lizards from the shape and measurement of their vertebrae (Smith 1975 & 1976). Two new species arose from Meredith's study of the Naracoorte fossils: a giant malleefowl *Progura naracoortensis* (van Tets & Smith 1974), and a giant primitive snake *Wonambi naracoortensis* (Smith 1976). Her interest in fossil snakes continued and in 1985 she described (Smith & Plane 1985) a new boid snake *Montypythonoides riversleighensis* from the World Heritage deposits at Riversleigh in Queensland.

A feature of her papers was the meticulous attention to detail. Descriptions of diagnostic characteristics and references were usually accompanied by drawings and/or photographs as well as tables of numerous measurements. Meredith's academic output was prodigious and during her scientific career she produced, or contributed to, two books on Australian mammals (Smith & Ganf 1980; Aslin, Smith & Ganf 1987), chapters for natural history books (Smith 1989a & 1996b), and species descriptions (Smith 1983, 1985, 1995), together with nearly 50 papers and a number of semi-popular articles. She was a member of the Australian Mammal Society and had edited the journal 'Australian Mammalogy' and the Bulletin in 1976. The list of her publications can be found at the end of this tribute.

In 1967 she married fellow student Murray Smith, and they had three children, Felicity, Tiffany and Matthew. After two years in Armidale, New South Wales, they returned to Adelaide and moved into their property at Norton Summit. Here they were able to cultivate fruit trees and Meredith kept a menagerie of animals, including a couple of horses, a pony, several donkeys as well as many bantams and ducks. She also bred sugar gliders and later brush-tailed bettongs. Meredith obtained part-time work as a demonstrator, first at Flinders University and later in the Zoology Department of the University of Adelaide.

It was here that I first met her in 1976. The meeting arose from my desire to learn more about the identification of the remains of small mammals found in owl pellets, which had been collected by some of my students during a Mawson High School field camp to Chambers Gorge in September 1975. In early October 1975, I forwarded this collection to Hans Mincham, then Information Officer at the South Australian Museum. As a result of Hans Mincham's report that the material contained rare and extinct species of rodents and small marsupials (identified by Meredith), many of which had never been found in the Flinders Ranges before, I returned to the site in May 1976. These collections, together with material collected by other individuals at Aroona Dam and Copley, prior to May 1974, formed the substance of a paper titled 'Remains of Mammals, including *Notomys longicaudatus* (Gould) (Rodentia: Muridae), in owl pellets from the Flinders Ranges, S.A.' published in *Australian Wildlife Research* in 1977. Here Meredith described for the first time the wealth of small mammals which had once populated the Flinders Ranges region. My interest aroused, I made six more trips to Chambers Gorge between September 1976 and October 1978 to determine the extent of the subfossil deposits in the central and eastern ends of the gorge. Meredith played a major role in helping to identify the material and to train me in its identification.

In May 1979 I invited Meredith, Murray and

their children to accompany me on a field trip to the eastern end of Chambers Gorge. The aim was to enable Meredith to see the Cave D site in the centre of Chambers Gorge, which had been the main source of old owl pellets for the 1977 paper, and to collect more pellets and bones. While Meredith and I excavated the floor of a new cave at the eastern end of the gorge, Murray took my two boys and his children to the old Moorowie Copper Mine. Here, he descended the rickety old wooden ladder (pre-1900 vintage) to the bottom of the shaft while the children waited at the surface. Our shallow excavation revealed the presence of a mat of grass, a wax match, parts of the page of a novel, part of a pamphlet referring to gunpowder and the lead of a large calibre bullet, indicating that the cave had once been used by miners. More interesting still, the cave also had evidence of occupation by stick-nest rats (*Leporillus* sp.), brushtail possums, ghost bats and barn owls. After this trip Meredith commenced to write a second paper on dasyurid remains found in the Chambers Gorge Cave D site as well as material from Big Moro Gorge and Top John Gorge north of Chambers Gorge. This paper (Smith & Medlin 1982) was presented by Meredith at a symposium on 'Carnivorous Marsupials' organised by the Royal Zoological Society of New South Wales, in May 1980.

Murray's death from bowel cancer in late 1980 was a devastating blow to Meredith, who was now left to manage the large Norton Summit property and to bring up three young children alone. To support her family and herself Meredith joined the Institute of Medical and Veterinary Science at Gilles Plains as an animal laboratory scientific officer, working part-time on the breeding biology and husbandry of Australian mammals, particularly marsupials. This department within the IMVS was transferred to the administration of the South Australian Museum in 1983 and became known as the Evolutionary Biology Unit (EBU). In November1983, Meredith presented a paper to the Australian Mammal Society's 'Possums and Gliders Symposium' held at the University of Armidale. Here, she described for the first time, the male and female reproductive systems and paracloacal glands of sugar gliders (*Petaurus breviceps*) and Leadbeater's possum (*Gymnobelideus leadbeateri*).

By the late 1980s her main research was centred on the breeding biology of *Bettongia* species and in particular the brush-tailed bettong (*Bettongia penicillata*). In 1992 the focus of EBU changed when it shifted from its location at Gilles Plains to the Division of Natural Science in the city, giving greater emphasis to molecular biology, and the live animal work was terminated. The loss of her beloved bettongs at Gilles Plains caused Meredith much grief, but she was able to retain a number of bettongs at home and to continue with her scientific work, while still working part-time at the South Australian Museum. Just before she left for Kenya, she was still studying the intricacies of the reproductive system of the brush-tailed bettong and had become very excited by a structure that she had recently dissected out from a female bettong.

Some additional tasks which formed part of Meredith's brief at the Museum included: management of the histology laboratory, advice to the Curator of Mammals on the identification of specimens in the mammal and subfossil collections, contributions to public programs and to review manuscripts as requested by scientific peers and editors in the CSIRO and tertiary institutions. Over the past 18 months, she had completed a paper on 'Establishment of a captive colony of *Bettongia tropica* by cross-fostering; and observations on reproduction' (Smith 1998) and was in the process of completing the description of a new species of extinct hopping-mouse from the Flinders Ranges. She had also completed the morphological analysis of the reproductive system and skeleton of a uniquely deformed kangaroo. Over the past two years she contributed to three public programs, viz. text for 'Nocturnal 1997', a unique exhibition by two artists of nocturnal animals; 'Extinctions SA' and 'Lost Fauna of Adelaide' where, as a key member of the team responsible for producing the exhibition, she provided captions and maps for extinct mammals on display.

Meredith occasionally participated in field work and during an earlier trip in June 1985 she visited Dalhousie Springs. This work resulted in a chapter on 'Mammals from the Dalhousie Springs Area, with Notes on some Reptiles and Frogs' in 'Natural History of Dalhousie Springs' by Zeidler and Ponder (1989). During 1997 she joined the Waterhouse Club expedition to the Flinders Ranges to share her expertise.

Outside of her scientific work, Meredith was able to continue her interest and love of animals. She was a member (and one-time secretary) of the S.A. Waterfowl Club Inc. and the S.A. Poultry Association and exhibited bantams and ducks of various breeds very successfully. In addition to keeping horses and

donkeys on her property at Norton Summit, Meredith was a long-time member of the Black Hill Pony Club.

A simple but moving service was held in St John's Anglican Church, Norton Summit with the eulogy being given by Meredith's aunt and Jacob Van Dissel from the pony club. In life, Meredith was a very private person and she probably would have been surprised at the number of her colleagues, friends, neighbours, and members of the above clubs, who came to the church to mourn her passing. This in itself was a measure of the esteem in which she was held. The funeral service was followed by a private cremation.

Meredith is survived by her mother, two daughters Felicity and Tiffany, and her son Matthew.

Acknowledgments

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THE EGYPTIAN COLUMN AT THE SOUTH AUSTRALIAN MUSEUM

MICHAEL O'DONOGHUE

Summary

It is nearly a century since the Egyptian Column was erected in the forecourt of the South Australian Museum. This article provides a description of the column, an account of its archaeological discovery in the temple of the god Herishef at Heracleopolis, the history of its coming to Adelaide and a translation of its hieroglyphic inscription.

THE EGYPTIAN COLUMN AT THE SOUTH AUSTRALIAN MUSEUM

MICHAEL O'DONOGHUE

O'DONOGHUE, M. 1999. The Egyptian Column at the South Australian Museum. *Records of the South Australian Museum* **31**(2): 127–147.

It is nearly a century since the Egyptian Column was erected in the forecourt of the South Australian Museum. This article provides a description of the column, an account of its archaeological discovery in the temple of the god Herishef at Heracleopolis, the history of its coming to Adelaide and a translation of its hieroglyphic inscription.

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Introduction

On 7 July 1999, the Egyptian column will have graced the lawns in front of the South Australian Museum for a century (Figure 1). It has become a cultural landmark in Adelaide with generations of South Australians and visitors to the state wandering past it and wondering at the civilisation which gave it birth. The possession of such a column is a distinction which the South Australian Museum shares with only a handful of museums around the world.

Information about the column exists in a number of places including the original archaeological reports and the archives of the Museum but this information has never been brought together and published. Alan Rowe in his manuscript 'A Guide to the Egyptian Antiquities in the South Australian Museum' (1920), discussed the column at length, but he was not aware of William Matthew Flinders Petrie's work (Petrie 1905) and his manuscript was never published. The purpose of this article is to describe the column and its original and modern contexts as fully as possible. To do so I will survey the history of the column, its origins, its location in the portico of the temple of Herishef, its archaeological discovery and its donation to the South Australian Museum. I shall also translate the hieroglyphic texts it carries.

Description

The column was carved from a single piece of granite which came from Aswan in upper Egypt. When discovered it was in two pieces and the mend can be clearly seen in the middle register. Its capital was also missing. A replica of the capital was carved in Adelaide of Murray Bridge granite using a cast of a capital from a matching column which was supplied from the British Museum. The capital consists of an abacus supported by nine palm fronds. At the base of the fronds a number of circular bands have been

FIGURE 1. The Egyptian Column in the forecourt of the South Australian Museum. Photograph: South Australian Museum Photographic Library.

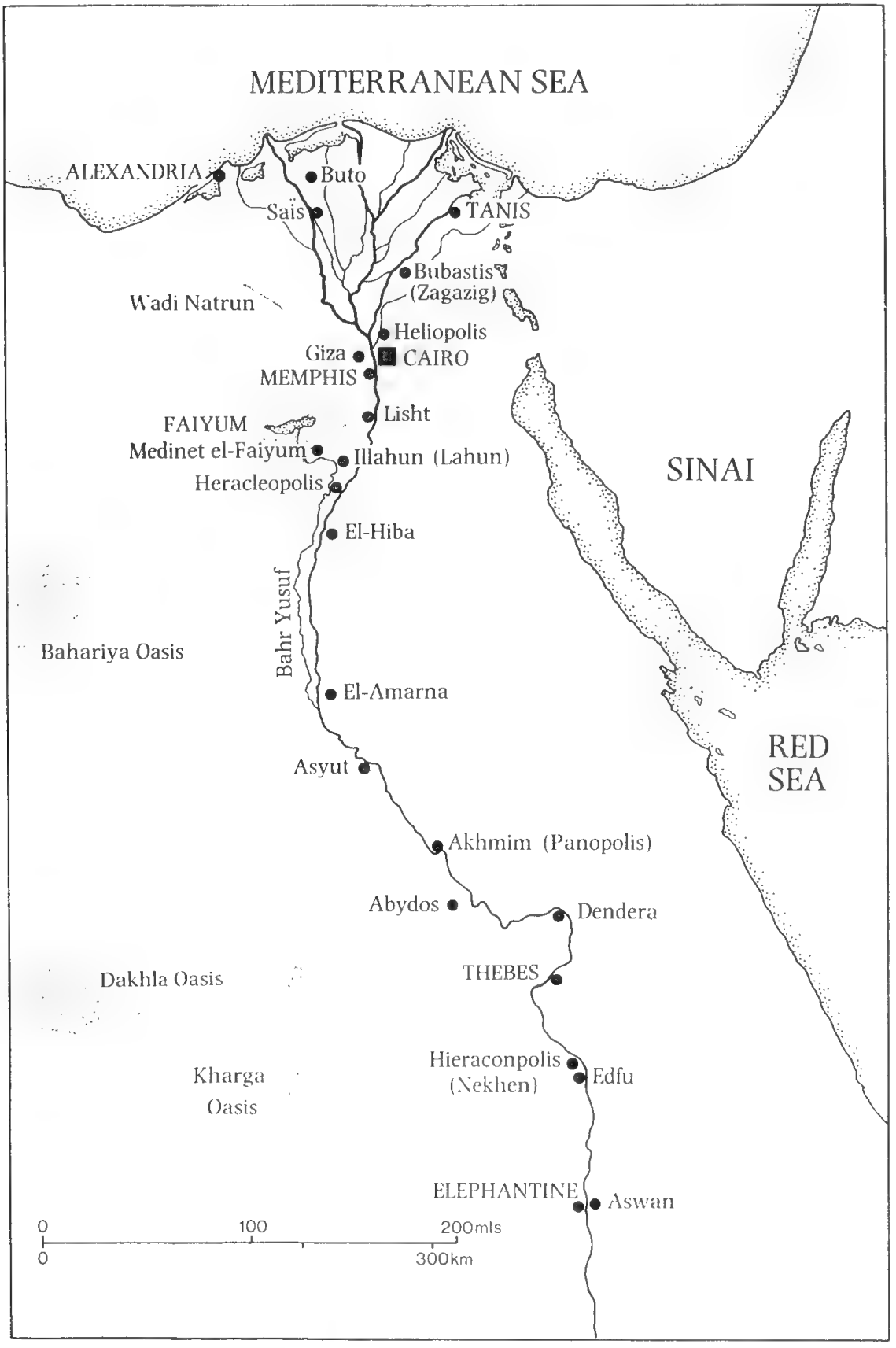
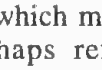


FIGURE 2. Map of Egypt showing location of Ihnasya el-Medina (Heracleopolis on map). Note the location of Aswan, the source of the granite for the column. From James 1988:8, copyright Trustees of the British Museum, British Museum Press.

carved. Below these is the shaft which has a slight narrowing towards the top. The intention is to represent a palm tree and it may be compared with the real palms planted around it in its present location on the museum lawns. Ramesses II made use of the smooth shaft to inscribe his name and titles in vertical columns, together with scenes of him offering burning incense to the god Herishef. His son Merneptah began to add his own names, and these can be seen as very faint traces between the vertical columns of Ramesses in the lowest register. The base of the column is of local construction.

According to Petrie (1905: 14) the diameter of the column is 29.9 inches (75.8 cms) at its base, and 25.1 inches (63.6 cms) at the top of the shaft. The height of the shaft from the base to the bottom of the bands at the top of the shaft is 142 inches (360.5 cms). The bands, palm fronds and abacus are the local reconstruction.

Ihnasya-El-Medina

The column comes from the temple of the god Herishef in the Egyptian town which bears the modern Arabic name of Ihnasya el-Medina and which was known during the Greco-Roman period in Egypt as Heracleopolis Magna. Its ancient Egyptian name was Nen-neswet (*Nn-nswt* ), which means '[the city] of the Royal Child', perhaps referring to the god Horus (Mokhtar 1983: 62f). As the map (Figure 2) shows, this site is in middle Egypt about 120 kms south of Cairo, just south of the entrance to the Faiyum depression. It stands about 10 kms to the west of the Nile and on the east bank of the large canal now called the Bahr Yussef which, after flowing from the Nile and running parallel to it, eventually flows into the Faiyum.

The ancient site of Heracleopolis is represented by a series of mounds which encompass the modern town of Ihnasya el-Medina from the west and south-west (Mokhtar 1983: 71). Over time the mounds have been partially excavated in search of monuments, *sebakh* (the valuable fertiliser which is the result of the manufacture of ancient bricks from Nile mud and straw) and limestone. Little is now to be seen on the surface.

The earliest mention of the city in Egyptian texts is from the 5th Dynasty (c.2498–2345 BCE)[1] during the Old Kingdom. In the First Intermediate Period (9th and 10th Dynasties 2160–2040 BCE), when central authority in Egypt was weakened, the rulers of Heracleopolis claimed to be rulers of all Egypt. From the Middle Kingdom onwards the city was clearly important and is frequently mentioned in the Egyptian texts. The nearby necropolis of Sedment seems to have been the burial ground for the ancient city and tombs have been found there from most eras in Egyptian history (Mokhtar 1983: 100ff).

The city was called by the Greeks, and then by the Romans, Heracleopolis Magna. Heracleopolis means 'the city of Herakles' and it seems to have been so named because the Greeks identified their god Herakles with the Egyptian God of the locality, Herishef. *Magna* means 'great' to distinguish it from another city with the same name which was given the designation *Parva* 'small'.

Heracleopolis Magna is mentioned by several classical authors writing on Egypt. Strabo (*Geographia* Book XVII 1.39), who spent a number of years in Egypt following a journey up the Nile in 25–24 BCE, and Pliny (*Natural History*, Lib. V: 9–4, 11) (23–79 CE) both mention it as an important city in Egypt. These and other references over the next centuries reflect its importance in Greco-Roman and Christian Egypt.

Excavation Of The Temple

The site was first excavated by Edouard Naville for the Egypt Exploration Fund in 1891. His account, published in 1894, was rather sketchy (Naville 1894) but he must be credited with the discovery of the site of the New Kingdom temple of Herishef and with the conclusion that it could be traced back to the Twelfth Dynasty (1991–1782 BCE). The area of the archaeological site is huge and Naville admitted that it was pure chance that he found the site of the temple of Arsaphes, as he called Herishef. He made several soundings until about five metres below the modern surface he hit upon a column capital and dug all around it:

> We thus cleared what I believe to be all that is still extant of the great temple of Arsaphes. It is a rectangular hall, in the forepart of which is a row of six granite columns (Naville 1894: 9).

This seems to refer to what Petrie (1905) was to

[1] Scholars have adopted the less Euro-centric convention of using BCE (Before Common Era) and CE (Common Era) in place of BC and AD but the year numbering remains the same.

call the portico with its columns (section II in Figure 8). The Adelaide column is one of these. To clear what Naville thought was the temple required the removal of over 40 000 cubic metres of earth. He recorded that only one of the columns was perfect. It is now in the British museum. Inscriptions on both sides of the doorway behind the row of columns, which gave access to the inner courts of the temple, recorded that the monument was erected by Ramesses II to his father Herishef. Naville found sections of the architrave, which had been reused, with the name of Senusert II still discernible. Since he was a pharaoh of the Middle Kingdom, Naville concluded that an original Twelfth Dynasty temple stood on the site, although he could not identify any of its plan. He also discovered the bases of a colonnade beyond the vestibule and a very well preserved, though broken in two, statue of Ramesses II with much of the original colour still in evidence.

Unfortunately Naville did not publish any plan of the discoveries and so the three photos he included become vital for restoring the original location of the finds. The photos show the positions of the columns when excavated, including the one which was to end up in Adelaide (Naville 1894: Frontispiece and Plates V, VI).

Naville must have immediately arranged the removal of the columns, presumably to England, from where they were rapidly distributed around the world. The Adelaide column was offered to the South Australian Museum late in 1891 (Amelia Edwards' letter dated November 1891, State Records of South Australia GRG 19, Series 58), the same year it was discovered. This hasty removal and the lack of any plan of the site were to cause problems for the next excavator.

In 1904 Petrie also excavated at Ihnasya. On the basis of his re-excavation on a more extensive scale, Petrie reconstructed the history of the temple (Petrie 1905). He concluded that in the Twelfth Dynasty (1991–1782 BCE) a smaller temple had been erected, probably by Senusert II and Senusert III, since their cartouches appear on blocks which were reused in later reconstructions of the temple. Petrie also suggested that the granite columns came from this Middle Kingdom temple although he was not sure where the structure was located at that time. As we shall see, the question of the original setting of the columns is still contested. In the Eighteenth Dynasty, perhaps under Tuthmosis III (1540–1504 BCE), the temple was reconstructed on a new plan which included the portico and the reuse of the columns. Then, in the Nineteenth Dynasty, Ramesses II (1279–1212 BCE) added to the temple and raised the columns on granite bases. He also inscribed the columns with his cartouches, as we see today. His son and successor, Merneptah, began to add his own cartouches. Later still, perhaps in the Twenty Third and Thirtieth Dynasties, the temple underwent further restorations. At some time, the columns were raised further by the insertion of white sandstone bases between them and their original granite bases. Having base and column of such differently coloured stone seems rather unconventional. The sandstone bases were inscribed with the name of Ramesses II. If they were not added by him, they must have come from one of his constructions elsewhere.

Petrie was rather unimpressed with some aspects of Naville's work. He was critical of the lack of a plan of the temple and of any diagrams showing the location of finds. He also drew attention to some of the errors made by Naville in recording the site.

The columns had already been removed by Naville; all that remained was one capital, which Petrie said belonged to the column which had been sent to Bolton in England. This made it difficult for Petrie to draw a plan of the locations of the individual columns. Furthermore Petrie found that the few measurements Naville had given were incorrect. However, on the basis of the photos taken by the Rev. W. MacGregor and published in Naville (1894), Petrie believed he had reconstructed, to within a few inches, the positions of the columns (Figure 4).

The columns had been distributed without any measurements being taken. So Petrie asked the curators of the Museums to which the columns had been sent to measure the columns for him. We do not know who measured the Adelaide column for him but Petrie included its measurements and noted that it was in Adelaide (Petrie 1905: 14).

All of this meant he could identify the locations of the columns in the temple and identify each in the photos. On this basis he drew up his reconstruction of the portico (Figure 3).

It can be noted that Petrie's reconstruction features four columns on each side of the entrance for a total of eight. This is despite the fact that only six had been found, and he could not find any remains of the two extra columns or their bases! He argued that without two additional central columns, the architrave, which he reconstructed from the remnants of its inscription, would not have been able to span the distance

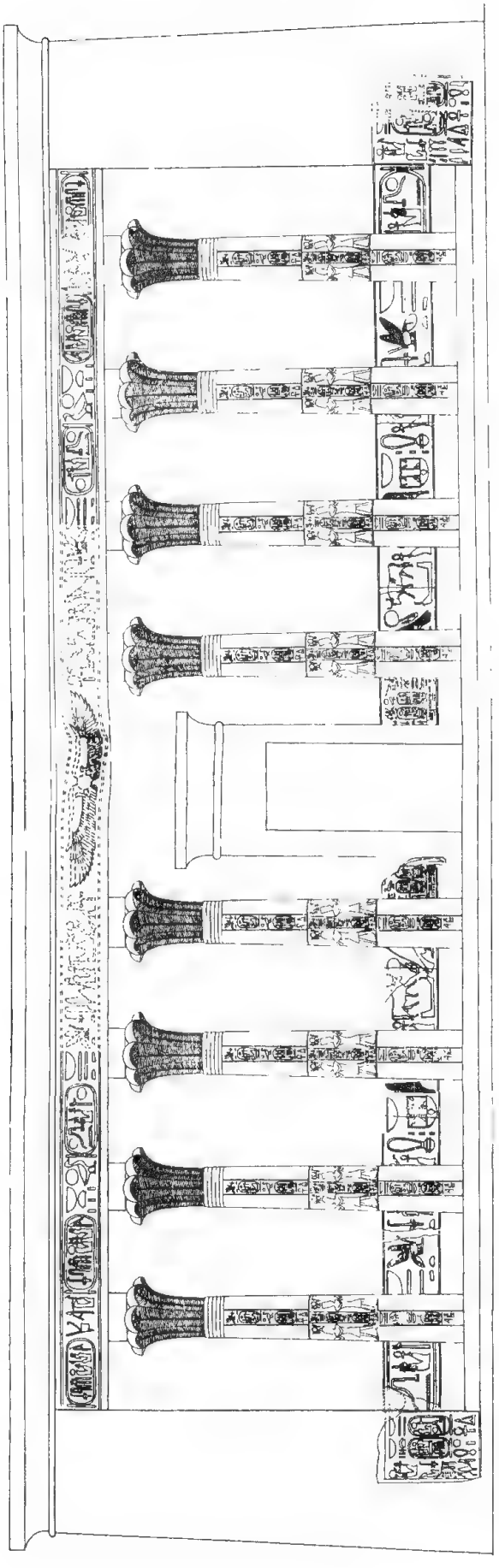


FIGURE 3. Petrie's reconstruction of the temple portico. From Petrie 1905, Plate VIII, top diagram.

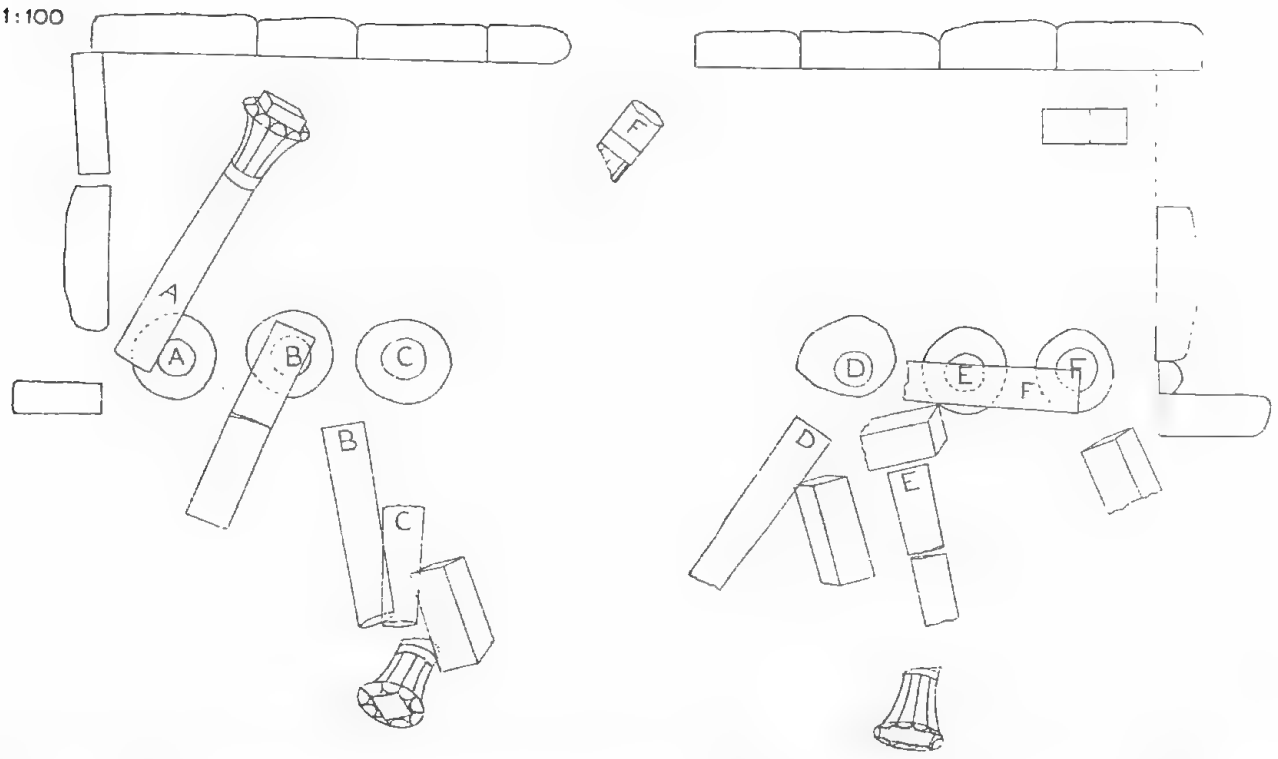


FIGURE 4. Petrie's reconstructed drawing of the temple portico, including the location of the columns, as discovered by Naville. From Petrie 1905, Plate VIII, bottom diagram.

FIGURE 5. General View of the Temple of Heracleopolis Magna. From Naville 1894, Frontispiece.

between the next two columns. If this is accepted it raises the intriguing question as to when and how all traces of the two extra columns were removed. Based on the following reconstruction the Adelaide column is the third from the left (i.e. column C).

Figure 4 is Petrie's reconstruction of the temple portico as discovered by Naville. The line of blocks at the top of the diagram is the lowest course of the inscribed limestone wall of the facade which stood behind the columns and was roofed to form a colonnade. In the centre is the doorway which gave access to the inner courts of the temple. The drawing reconstructs where Petrie concluded the columns and their respective bases were found by Naville. Column A is the complete column in the British Museum, column B is in Boston (the object lying on top of base B is not a column but an inscribed block as can be seen in the photo, Figure 5), C is the top section of the Adelaide column (part of which must have been found outside the area of Petrie's drawing), D is the column in Manchester, E is the column in Bolton and F is the column in Philadelphia.

Petrie based his reconstruction on the following three photos from Naville's report as well as his own excavations of the bases of the columns. It was a clever piece of archaeological detective work, for which Petrie was justly famed.

Figure 5 provides a general view of the portico (compare with Petrie's diagram above). The line of inscribed blocks running across the centre of the photo is the lowest course of the facade of the portico which stood behind the row of columns; on the far left is column A with its capital intact; in the middle foreground lies column B and behind it the top section of column C, the Adelaide column; the top of column F can be seen just in front of the entrance doorway in the facade; to the right, column D lies still half buried in the debris and on the far right midground is column F. Perhaps the section of column which can just be made out in the right hand bottom corner of the photograph is the other section of the Adelaide column. Petrie's drawing does not extend far enough to include this.

In Figure 6, making use of Petrie's diagram, we can identify, in the foreground, column B now in Boston and, nearby, the capital which presumably belongs to it. Immediately behind it is the top section of column C, the Adelaide column. In the

FIGURE 6. Columns and Architraves from the Vestibule of the Temple of Heracleopolis Magna. From Naville 1894, Plate V.

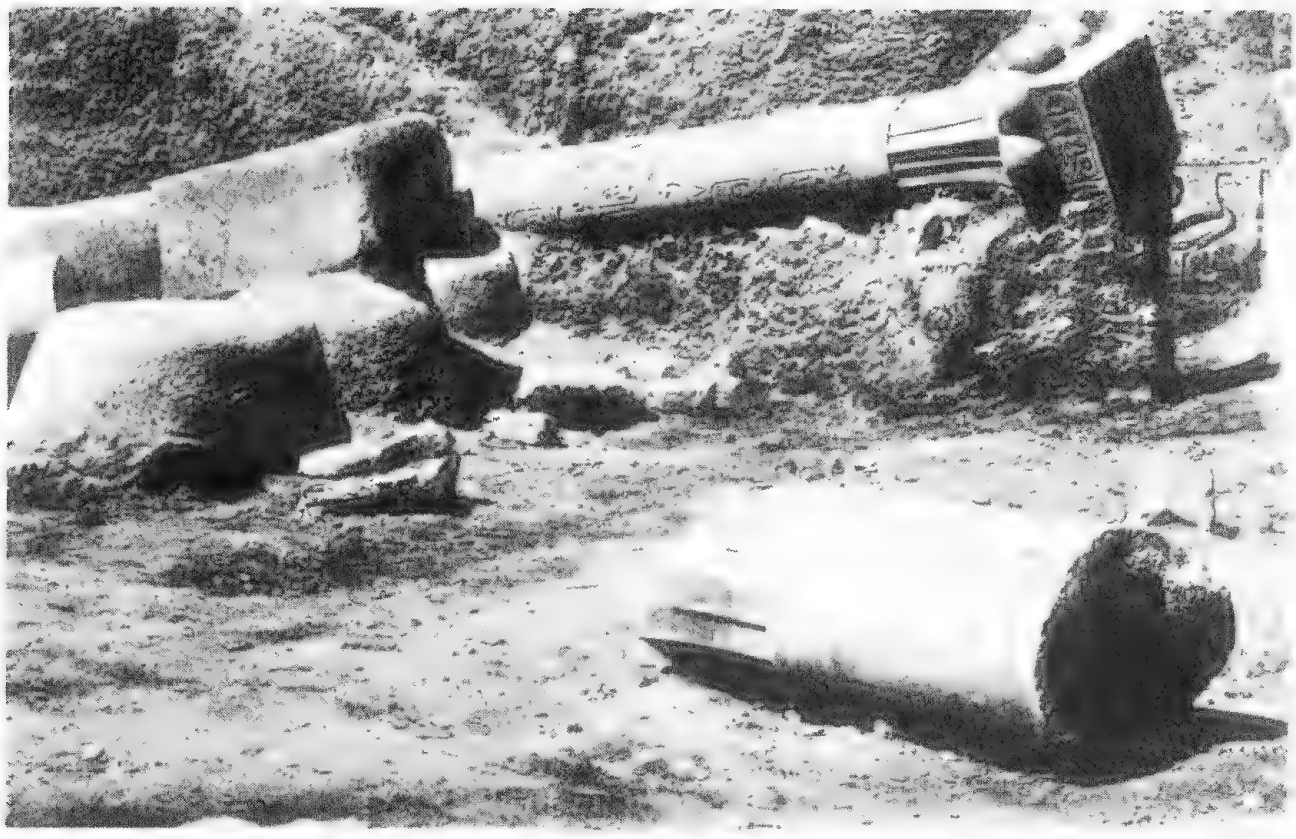


FIGURE 7. Columns and Architraves from the Vestibule of the Temple of Heracleopolis Magna. From Naville 1894, Plate VI.

right midground is column D now in Manchester and, above it, in the top right hand corner, column F now in Philadelphia.

In Figure 7 we can identify, in the right foreground, the top of the shaft of column F which also includes the bottom section of the palm capital. In the background is the complete column A now in the British Museum. On the left, one behind the other, are the granite bases of the three left hand columns.

General Plan Of The Temple

The full extent of the temple at the time of Ramesses II was revealed by Petrie and is shown in Figure 8. The entrance was through a large open courtyard (I) which was flanked by rows of columns fronted by statues. Mokhtar (1983: 81) says these columns were of granite with palm leaf capitals but it is not clear where he obtained this information as the columns were entirely missing. He may be confusing them with the columns of the portico. The columns were more likely of limestone.

At the eastern end of the courtyard was the portico (II) from which the Adelaide column comes. This portico served as the entrance to the inner parts of the temple and consisted of a covered colonnade fronting an inscribed facade, which measured about 18.5 m. by 6.3 m (Petrie 1905: 13). The inscription on the facade consisted of hieroglyphic signs 60 cms high and gave the name and titles of Ramesses II. This was followed by the text 'He erected [it] as a monument for his father Herishef, the King of the Two Lands.' (Mokhtar 1983:83).

The entrance through the portico gave access to the hypostyle hall (III), one of the oldest parts of the temple (Mokhtar 1983: 86). Here Petrie discovered the small (6 cms high), solid gold statue of Herishef dating from about 730 BCE which has been called 'one of the largest and finest gold figures known to be excavated in Egypt' (Mokhtar 1983: 86–87). The statue weighs 35 grams and is now in the Museum of Fine Arts, Boston.

Next was the small hall (IV) which originally had four columns and later eight. Only the bases remain.

Finally there was the sanctuary area (V) of which little remained. Petrie suggested it consisted of a central sanctuary and two side

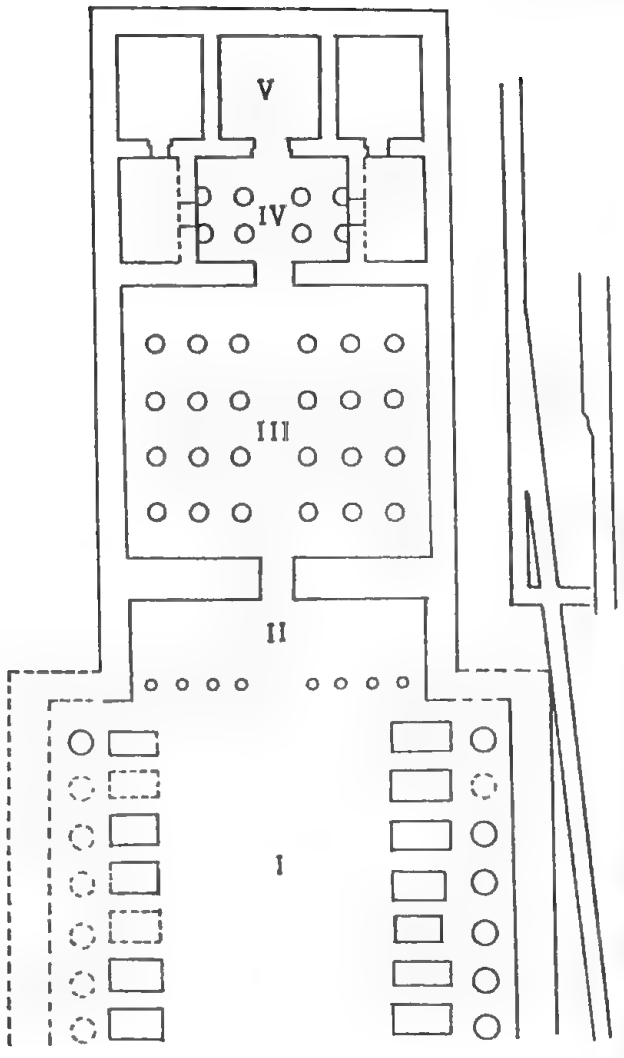


FIGURE 8. General Plan of the Temple of Heracleopolis Magna. From Mokhtar 1983:88, Figure 18.

rooms. The layout of the temple reflected the canon of the Egyptian cultic temple of the New Kingdom. This included a series of halls leading eventually to the sanctuary where the statue of the god resided in its shrine as the focus of the daily temple ritual.

Petrie found no evidence of a temple on the site prior to the Middle Kingdom, discovering only a few re-used blocks which may be dated to an earlier era. However, Mokhtar (1983: 77) argues that a temple existed on the site from the First Dynasty. He notes that a temple of Herishef is mentioned on the Palermo Stone. Furthermore the prominence of the city in the later lists of cities of Egypt and its significance in mythology, suggest it must have had a significant temple at an early date. Mokhtar believes the archaeological evidence for a temple may have been destroyed when the city was conquered by the Theban rulers of the 11th and 12th Dynasties. It is also possible that the earlier temple was in another part of the largely unexcavated site.

The Origin Of The Columns

As Petrie remarked (1905: 7), 'The granite palm columns of the portico have been recognised as probably of the XIIth Dynasty since they were found . . .' He suggested that their position in the portico may have been established during the 18th Dynasty rebuilding, and inscriptions were added

FIGURE 9. Palm column in the mortuary temple of the Pyramid of Sahure at Abusir. Author's photograph.

to the columns by the 19th Dynasty pharaoh Ramesses II and his son Merneptah. If they were from a Middle Kingdom structure, their original location remains unknown.

Rita Freed of the Boston Museum has suggested an earlier origin for the columns (personal communication, 16 August 1994). She has traced their origin based on the style of the palm capitals. She argues that they are typical of palm capitals of the Old Kingdom belonging to the pyramid temples of Unas and Isesi at Saqqara, and of Sahure at Abusir. In this case the closest similarities are with the columns of Isesi (5th Dynasty, c.2414–2375 BCE). This suggests that the columns could have been taken from the mortuary temple of this king (cf. Figure 9). As William Stevenson Smith has commented, referring to the column in the Boston Museum,

> There is little either in the proportions or the treatment of details to distinguish this column from the Old Kingdom form as it is found in the temples of Sahura and Unas (Smith 1960: 79).

There is no evidence to determine whether the columns were removed from Saqqara to Herakleopolis sometime after the Old Kingdom or whether they belonged to an Old Kingdom structure at Herakleopolis. However, there is no doubt about their reuse in the reconstructed 18th Dynasty temple or their later inscription by Ramesses II.

The God Herishef

The temple was dedicated to the god Herishef, who is depicted on the Adelaide column receiving offerings from Ramesses II. The other columns feature other gods in the same position. Herishef is depicted as a man with a ram's head. There were many ram gods in Egypt, among the most important being Amun of Thebes and Khnum of Elephantine. The ram seems to have been chosen to represent divinity because it was linked with fertility and sexual power. Amun was represented by a species with curled horns which came to Egypt from the Middle East during the Middle Kingdom. The ram representing Herishef was of a different species with more ancient local origins and has horizontal horns which are twisted (Altenmüller 1977: 1015). He usually held the *was* (*w3s*) sceptre and wore the Atef crown which was worn by kings and gods. This crown included the tall white conical crown of upper Egypt surmounted by the sun disk, and with feathers on each side. At the base of the crown were the two horizontal ram's horns.

FIGURE 10. The God Herishef. From Mokhtar 1983:157, Figure 26.

The god's name, Herishef (*Ḥry-š.f*) means 'He who is upon his lake.' Some think this lake refers to Lake Moeris, the large lake in the Faiyum because Ihnasya is so close to this area (Mokhtar

1983: 147). On the other hand it may refer to a more local body of water which is no longer identifiable, perhaps even the sacred lake customarily attached to each temple. The Greeks transcribed the god's name in such a way that it was read as Harsaphes (or Arsaphes) by scholars. Hence the variations in the writing of the name found in different texts.

The Column Comes To Adelaide

In November 1891, Amelia B. Edwards, the famous Honorary Secretary of the Egypt Exploration Fund, wrote to the 'National Museum of South Australia' [sic] offering to donate to the Museum two fragments of a column of Ramesses II (Letter, State Records of South Australia GRG 19, Series 58). This offer may have been an outcome of the earlier visit to London by Rev. William Roby Fletcher who was gathering Egyptian antiquities for the Museum (*The South Australian Register*, 8 July 1899). Roby Fletcher was in London in mid-1890 and in his report he mentions that he approached the Egyptian Exploration Fund and was told that only subscribers to its work could receive objects from its excavations (Fletcher 1891: np). C. E. Owen Smyth stated in his reminiscences that the pieces of the column had been presented to Roby Fletcher while he was in England (*The Register*, 25 October 1923).[2] However, neither Roby Fletcher nor Amelia Edwards' letter mention such a presentation and it may simply have been that the Fund knew of the interest of the South Australian Museum because of Roby Fletcher's visit and so wrote with the offer.

In a letter dated January 6 1892, the general director and secretary of the Museum committee, Rob Kay, replied to Amelia Edwards that the members of the committee 'accept this donation with much pleasure' (State Records GRG 19/14 Vol. 13 Folio 97 and 98 Letter Book; see also Folio 96 for letter to SA Agent General in London asking that arrangements be made for transport). He added that the committee 'would be glad to have one of the plaster casts of the capital of the column referred to in your letter'. He also inquired as to what type of base, if any, the column should have. The column arrived in early 1892 and, when accession numbers were assigned many years later, it was given the number A40015. It was to remain in its boxes (the two pieces were packed in separate boxes) for the next eight years.

There are slightly different accounts of the decision to erect the column. Without noting the year, Hale (1956:72) reports that the Museum committee was concerned because the entrance to the Museum was being interfered with by the local military force which used the square in front of the North wing as its drill-ground. The committee urged the Board of Governors of the Public Library, Museum, and Art Gallery to grass the area and erect the column to keep the military away! Since the first dedicated Museum building, the North Wing, was constructed in 1893 and formally opened on 12 January 1895, this urging must have been about this time.

The Superintendent of Public Building of the time, Mr. Charles Edward Owen Smyth, has a different story. In his reminiscences he notes that when he was landscaping the area in front of the North wing of the Museum he asked for the column to form a centre piece. Although it is not entirely clear, he seems to suggest that the new Parade Ground behind Government House was already in use from 1892 and mentions that the drill shed was moved to the new Parade Ground without providing a date. Since the column pieces were stored and the capital carved in the drill shed, it must have been removed as part of the landscaping associated with the erection of the column (Owen Smyth 1923 op. cit.). In the speeches at the unveiling of the column in 1899, reference was made to a 'hideous drill shed which prevents us from appreciating the full beauty of this enclosure' (*The Advertiser*, 8 July 1899, p.8), so the drill-shed was not removed until after the erection of the column.

Owen Smyth, who was known as a person of forceful character, approached Mr (later Sir) George Brookman to assist in the erection of the column (*The South Australian Register*, 8 July 1899). A donation of £200 (Hale 1956: 72) was forthcoming. This enabled a capital to be carved

[2] Owen Smyth's reminiscences came thirty years after the fact and despite his intimate involvement in the events, in several respects seem to be incorrect. For example he mentions the column being in three pieces and that a cast of the base was supplied as well as of the capital, neither of which are supported by the contemporary letters. A scrap book of cuttings from the Register of all of Owen Smyth's reminiscences may be found in the Mortlock Library of South Australiana (V1011 – see References).

from granite which was mined at Lane and Opie's quarry at Swanport on the Murray. Today, when travelling from Adelaide towards the Swanport bridge over the Murray River, a large granite outcrop can be seen to the left of the highway which is known as Haystack Rock. This was the area of the Swanport granite quarry and may have been the actual site of the mining of the granite (personal communication, 7 December 1996 from Ken Wells, President, Murray Bridge Historical Society). Owen Smyth in his reminiscences tells how he and Sir Robert Thomas of *The Register* journeyed to Murray Bridge and 'saw some suitable red granite in a swamp some few miles down the river' (Owen Smyth 1923). This description would fit the area described above. Owen Smyth had the granite transported to Adelaide and stored in the old drill shed which still stood on the eastern side of the old Parade Ground in front of the museum building. Here the capital was cut as an exact replica of that on the complete column at the British Museum, a plaster cast of which had been provided at the time the column had been donated. The unveiling and positioning of the capital upon the shaft was carried out on the afternoon of Friday, 7 July 1899. Mr. George Brookman performed the ceremony. The speeches given on the occasion, in the presence of many of the dignitaries of the colony, were reported at length in the newspapers of the next day (*The Advertiser* and *The South Australian Register*, see References). Owen Smyth had planted some palm trees in the area a few years earlier as part of his landscaping of the northern side of North Terrace.[3] He now completed his vision for the area around the column by adding more palm trees. As he noted in his reminiscences:

> The palms were planted round about to make the old Egyptian ghosts who may haunt the column feel more at home, and incidentally to add to the beauty of the little green spot, so restful to the eyes on a blazing hot Australian summer day (Owen Smyth 1923).

This romantic interpretation should be considered in the light of the fact that he had used palm trees extensively in his landscaping of North Terrace for some years before the column was even donated to South Australia! (Healey 1996; Sumerling 1992).

The Annual Report of the Board of Governors of the Public Library, Museum, and Art Gallery for that year (Report 1899: 5) noted that the column had been erected and that Professor Edward von Blomberg Bensly of the University of Adelaide, who was Honorary Curator of Archaeology from 1897 to 1901 (Hale 1956: 72), had written to the British Museum for a translation of the inscription on the column. The details of the response from E. A. Wallis Budge are given later in this article.

When Alan Rowe was in Adelaide, between about 1915 and 1922, he prepared a catalogue of the Egyptian collection of the Museum (Rowe 1920). Unfortunately it was never published, but a painting by Gustave A. Barnes was prepared as the frontispiece for the intended publication. The painting showed an imaginative reconstruction of the column as it might have appeared in its original location. This painting is still held in the Museum archives (South Australian Museum, Anthropology Archives Acc. No. 126, GP No. 273), has been published in Robert Merrillees (1990: 26) and is reproduced here as Figure 11. It is obvious that Barnes used one of the photos in Naville's publication for the background (cf. Figure 6), adding the erect and complete Adelaide column to the foreground, despite the fact that the Adelaide column is depicted lying behind the erect column!

The Inscription

There have been at least two attempts to translate the inscriptions on the column. Neither, apparently, was published. The first translation was done soon after the column was erected. A letter exists in the files of the South Australian Museum (South Australian State Records GRG 19 Series 58) from E. A. Wallis Budge of the British Museum to Professor Edward von Blomberg Bensly. Wallis Budge had been sent photos of the column with the request to provide a translation. In his letter of the 21 March 1900 (Letter 2 315, State Records of South Australia GRG 19 Series 58) he offered a translation of some of the texts. He also suggested text for the column's identifying label and returned the photos on which he had indicated the sections of his translation. All of these may now be found in the archives.

The second, more comprehensive translation, was by Alan Rowe. Born in 1891 in England,

[3] These may be seen in a photo of the North Wing taken shortly after its construction in 1893 (Hale 1956, facing p.69).

FIGURE 11. Gustave A. Barnes' painting imaginatively reconstructing the Adelaide column among the ruins of the temple of Herishef. Photograph: South Australian Museum Anthropology Archive.

Rowe lived in Adelaide for a number of years and was appointed Honorary Custodian of Archaeology in the Art Museum.

> In 1918 Alan Rowe, then a young man, and later to become a well-known Egyptologist, compiled a catalogue of the archaeological collections and pointed out errors in the translation on the label describing the Ahnas Egyptian Column (Hale 1956: 129).

He produced a detailed transcription, transliteration and translation of the text on the column for his catalogue of the Egyptian Collection which unfortunately was never published. Rowe's translation has only minor differences from the translation which follows. Merrillees (1990: 36) gives an engaging account from Sir Mark Oliphant of his attendance at a lecture by Alan Rowe in about 1918 which began at the column and included a translation of its text before the group moved into the Museum to view the mummy and coffin of Renpit-Nefert.

The inscription on the column occurs in a horizontal cartouche on the top of the restored capital and in three vertical registers, or divisisions, on the shaft of the column. The three registers on the shaft of the column each take approximately one third of its height, so we can refer to upper, middle and lower registers. Interestingly the hieroglyphs on the south and east sides of the column face to the left and hence are read from left to right while those on the north and west sides face to the right and hence are read from right to left. This orientation was determined by the location of the column. We can see from Petrie's reconstruction (Figure 3) that the north side of the column in its current location would have faced the entrance to the temple. This side shows, in the middle register, scenes of Ramesses II facing towards the god Herishef who is depicted as though emerging from his temple. On the rear of the column was the inscription now found on the southern side, with which our translation begins.

The scene of Ramesses II making offerings to the god Herishef is in the middle register on the east and west sides. Ramesses is wearing the blue crown and Herishef is wearing the white conical crown, which bears a feather on each side and the sun on its top. At the bottom of the crown are the ram horns. Herishef holds in his outstretched left hand the *was* (*wꜣs*) sceptre of power and by his side the right hand holds the symbol of life, the *ankh* (*ꜥnḫ*). He also wears a lappet wig and straight kilt. Ramesses offers to Herishef, in his right hand, a cup bearing burning incense (the flame is indicated rising from the container). Ramesses wears a pointed kilt with carved details. He also wears a collar, as well as arm and wrist bands.

Each figure has his name inscribed above and in front of his crown. Ramesses' name is inscribed inside two cartouches (the name rings which enclose the Pharaoh's name) while Herishef's is simply made up of the signs for his name plus his divine determinative (the seated figure of the ram-headed god).

The column was broken when discovered and was shipped to Adelaide in two pieces. The join can still be seen across the centre of the middle register. The break did some minor damage to some of the inscriptions and figures.

In four panels on the lowest register there are traces, between the vertical inscriptions of Ramesses II, of other inscriptions which were apparently not cut so deeply or were never finished (inscription lines 6, 7, 22 and 23). As a result they can only be read with great difficulty and in the right light. This is why they are shown with cross hatching in the following transcription. The most legible is that on the south-east side of the column, when the sun or artificial light rakes across the inscription. It consists of the names of Merneptah, the thirteenth son and successor of Ramesses II. Interestingly, the very first hieroglyphic sign of Merneptah's inscription on the south-east side (line 6) which is the basket sign (*nb*) has been properly cut. It is the only sign of Merneptah's titulary which was finished. Does this mark the point where the carver was interrupted, never to return? The same inscription of Merneptah's name can be read with a good deal more ease on the column in the British Museum and it leaves one wondering if the exposure of the South Australian column to the elements has led to the fading of the carving.

The inscriptions on the column are repetitive, featuring time and again the throne name and personal name of Ramesses II in cartouches. The throne name was the name given to the king when he was crowned and is the name which often occurs in inscriptions. In Ramesses' case his throne name was something like User-Maat-Re-setep-en-Re, which if translated could mean 'Strong is the Truth of Re, chosen of Re'. His personal name was Ramesses, which probably meant 'It is Re who created [lit. gave birth to] him'. The enumeration of the Ramesses (e.g. Ramesses II, Ramesses IX) of course was not used by the ancient Egyptians but has been developed in modern times.

In the following, the transcription, transliteration, and translation of the text is given. The transliteration is a system modern scholarship uses to represent the sound of the Egyptian words. Vowels are missing because hieroglyphic writing didn't feature them. The lines are numbered from one to thirty three beginning on the south side of the column. While on the column the inscription is written in vertical columns (or lines), and often faces right to left, the entire inscription is given here reading left to right in horizontal lines so that the translation can be readily linked to the hieroglyphs. Sections which are cross hatched are either damaged or very difficult to read.

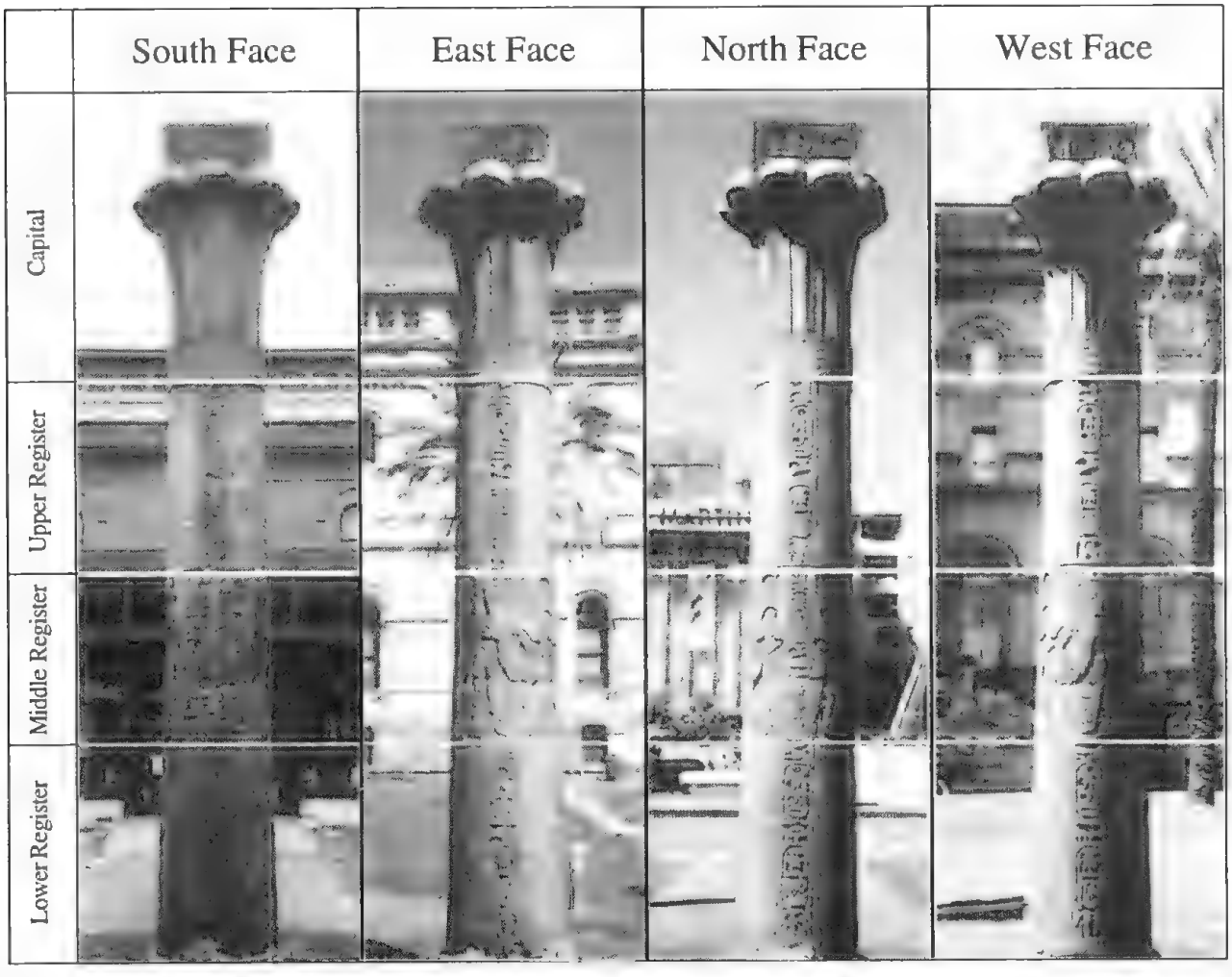


FIGURE 12. The four sides (or faces) of the South Australian Museum's Egyptian column showing the major divisions. Within each division the cartouches may be seen as either horizontal (e.g. on the capital) or vertical (mainly within the registers) lines of hieroglyphs. For easy reference each line has been numbered in the text, beginning on the capital of the South face with line 1 and finishing on the bottom of the West face with line 31. In the text all cartouches are drawn left to right irrespective of their orientation on the column. This allows the translation to be aligned with the relevant hieroglyphs (see below).

On the South side (i.e. the side of the column facing North Terrace), the middle register features two vertical columns with the throne name (line 3) and personal name (line 4) of Ramesses II followed by the epithet, 'beloved of Herishef'. In the lower register to the east of Ramesses II's inscription can be seen the faint outline of Merneptah's inscription (line 6) with the well carved basket (*nb*) at its beginning.

Line 1. Capital – South

Wsr-Mꜣᶜt-Rᶜ-stp-n-Rᶜ mry Ḥry-šꜣ.f
User-Maat-Re-setep-en-Re beloved of Herishef

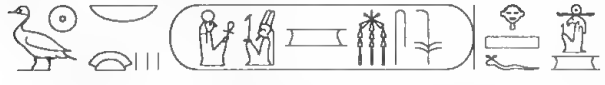
Line 2. Upper register – South

nsw-bity Wsr-Mꜣᶜt-Rᶜ-stp-n-Rᶜ sꜣ Rᶜ Rᶜ-ms-sw mry Ỉmn di ᶜnḫ
King of Upper and Lower Egypt, User-Maat-Re-setep-en-Re, son of Re,
Ramesses, beloved of Amun, given life

Line 3. Middle register – South

nsw-bity nb tꜣwy Wsr-Mꜣᶜt-Rᶜ-stp-n-Rᶜ mry Ḥry-šꜣ.f
King of Upper and Lower Egypt, lord of the two lands, User-Maat-Re-setep-en-Re, beloved of Herishef

Line 4. Middle register – South



sꜣ Rᶜ nb ḫᶜw Rᶜ-ms-sw mry Ḥry-šꜣ.f
Son of Re, Lord of Appearances, Ramesses, beloved of Herishef

Line 5. Lower register(centre) – South

nb tꜣwy Wsr-Mꜣᶜt-Rᶜ-stp-n-Rᶜ nb ḫᶜw Rᶜ-ms-sw mry Ỉmn mry Ḥry-šꜣ.f
Lord of the Two Lands, User-Maat-Re-setep-en-Re, Lord of Appearances,
Ramesses, beloved of Amun, beloved of Herishef

Line 6. Lower register(to right of line 5) – South

nb tꜣwy Bꜣ-n-Rᶜ mry nṯrw nb ḫᶜw Mr-n-Ptḥ ḥtp ḥr Mꜣᶜt mry Ḥry-šꜣ.f
Lord of the Two Lands, Ba-en-Ra, beloved of the gods, Mer-en-Ptah,
pleasing before Maat, beloved of Heryshef

Line 7. Lower register (to left of line 5) – South
Very difficult to read but similar inscription to line 6.

On the East side of the column, the middle register shows the scene of Ramesses II offering to Herishef. Their names are given just above and in front of their crowns (lines 10, 12 and 13). In front of the body and legs of each figure are inscriptions (lines 14 and 11) indicating that Ramesses II offers Herishef incense while the god offers the king, in return, stability, life, and power. Note that the hieroglyphs in these lines face toward the figure being spoken to, as though addressed to him and that, on this side, the hieroglyphs face from right to left (except for the inscription on the capital and those in front of Herishef) as described above.

Line 8. Capital – East

Rᶜ-ms-sw mr Ỉmn
Ramesses beloved of Amun

Line 9. Upper register – East

nsw-bity Wsr-Mɜᶜt-Rᶜ-stp-n-Rᶜ sꜣ Rᶜ Rᶜ-ms-sw mry Ỉmn mi Rᶜ
King of Upper and Lower Egypt, User-Maat-Re-setep-en-Re, son of Re, Ramesses, beloved of Amun, like Re

Line 10. Middle register (above crown of god) – East

Ḥry-šꜣf
Herishef

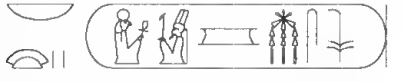
Line 11. Middle register (in front of figure of god) – East

dỉ.n n.k ḏd ᶜnḫ wꜣs nb
I have given to you all stability, life and power

Lines 12 and 13. Middle register (in front of crown of Ramesses) – East

nb tꜣwy Wsr-Mɜᶜt-Rᶜ-stp-n-Rᶜ

Lord of the two lands, User-Maat-Re-setep-en-Re



nb ḫᶜw Rᶜ-ms-sw mry Ỉmn
Lord of appearances, Ramesses, beloved of Amun

Line 14. Middle register (in front of Ramesses) – East

irt snṯr n it.f
Giving incense to his father

Line 15. Lower register – East

nb tȝwy Wsr-Mȝᶜt-Rᶜ-stp-n-Rᶜ nb ḥᶜw Rᶜ-ms-sw mry Ỉmn mry Ḥry-šf
Lord of the Two Lands, User-Maat-Re-setep-en-Re, Lord of Appearances, Ramesses, beloved of Amun, beloved of Herishef

On the North side of the column, there are three vertical lines of inscriptions—lines 17 (upper register), 18 (middle register), and 21 (lower register)—as well as the horizontal inscription on the capital, line 16. On the lower register, faint traces of Merneptah's vertical inscription can be seen either side of line 16 (lines 22 and 23). In the middle register the beginning of the offering scenes of the east and west sides involving Ramesses II can be seen in lines 20 and 19.

Line 16. Capital – North

Wsr-Mȝᶜt-Rᶜ-stp-n-Rᶜ
User-Maat-Re-setep-en-Re

Line 17. Upper register – North

nsw-bity Wsr-Mȝᶜt-Rᶜ-stp-n-Rᶜ sȝ Rᶜ Rᶜ-ms-sw mry Ỉmn di ᶜnḫ
King of Upper and Lower Egypt, User-Maat-Re-setep-en-Re, Son of Re, Ramesses beloved of Amun, given life

Line 18. Middle register (centre) – North

nsw-bity nb tȝwy Wsr-Mȝᶜt-Rᶜ-stp-n-Rᶜ sȝ Rᶜ nb ḥᶜw Rᶜ-ms-sw mry Ỉmn di ᶜnḫ
King of Upper and Lower Egypt, User-Maat-Re-setep-en-Re, son of Re, Ramesses, beloved of Amun, given life

Lines 19 and 20. Middle register – North

Above the head of Ramesses in both instances is a sun disk with two cobras (the cobra-goddess Wadjet, protector of the pharaoh) emerging from it. Each serpent carries the *ankh* symbol. Under this symbol is the title Behdet[y], meaning 'he who comes from the town of Behdet (Edfu)', a city sacred to the falcon-god, Horus who was identified with the pharaoh.

Bḥdt(y)
The one from Behdet

Line 21. Lower register (centre) – North

nb tȝwy Wsr-Mȝʿt-Rʿ-stp-n-Rʿ nb ḫʿw Rʿ-ms-sw mry Ỉmn mry Ḥry-šf
Lord of the Two Lands, User-Maat-Re-setep-en-Re, Lord of Appearances, Ramesses, beloved of Amun, beloved of Herishef

Line 22. Lower register (right) – North

nb tȝwy Bȝ-n-Rʿ mry nṯrw nb ḫʿw Mr-n-Ptḥ ḥtp ḥr Mȝʿt mry Ḥry-šf
Lord of the Two Lands, Ba-en-Ra beloved of the gods. Lord of Appearances. Mer-en-Ptah, pleasing before Maat, beloved of Heryshef

Line 23. Lower register (left) – North

Similar inscription to line 22, very difficult to make out.

On the West side of the column, the middle register shows the scene of Ramesses II offering to Herishef. Their names are given just above and in front of their crowns (lines 27 and 29). In front of the body and legs of each figure are inscriptions (lines 28 and 30) indicating that Ramesses II offers Herishef incense, while in return the god offers the king life and many festival celebrations.

Line 24. Capital – West

Rʿ-ms-sw mr Ỉmn
Ramesses beloved of Amun

Line 25. Upper register – West

nsw-bity Wsr-Mȝʿt-Rʿ-stp-n-Rʿ sȝ Rʿ Rʿ-ms-sw mry Ỉmn mi Rʿ
King of Upper and Lower Egypt, User-Maat-Re-setep-en-Re, son of Re, Ramesses, beloved of Amun, like Re

Lines 26 and 27. Middle Register (above crown of Ramesses) – West

nb tȝwy Wsr-Mȝᶜt-Rᶜ-stp-n-Rᶜ

Lord of the two lands, User-Maat-Re-setep-en-Re

nb ḫᶜw Rᶜ-ms-sw mry Ỉmn
Lord of appearances, Ramesses, beloved of Amun

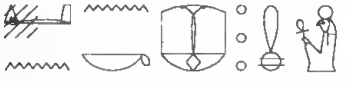
Line 28. Middle register (in front of figure of Ramesses) – West

irt snṯr n it(.f) ir.f di ᶜnḫ
Giving incense to his father, who gives the gift of life

Line 29. Middle register (above crown of god) – West

Ḥry-š.f
Herishef

Line 30. Middle register (in front of figure of god) – West



di n n.k ḫbw mi Rᶜ
I have given to you festivals like Re

Line 31. Lower register – West

nb tȝwy Wsr-Mȝᶜt-Rᶜ-stp-n-Rᶜ nb ḫᶜw Rᶜ-ms-sw mry Ỉmn mry Ḥry-š.f
Lord of the Two Lands, User-Maat-Re-setep-en-Re, Lord of Appearances, Ramesses, beloved of Amun, beloved of Herishef

Conclusion

From the time of its origins in the granite quarries of Aswan the Egyptian column has attracted to itself layer after layer of meaning. It began as a plain palm column in a temple of the Middle Kingdom, or perhaps even before that in a mortuary temple of the Old Kingdom. It was reused during the New Kingdom and inscribed by Ramesses II in devotion to the god Herishef. His son Merneptah added his layer by inscribing his own name. The column was discovered by Naville and donated to the South Australian Museum by the Egypt Exploration Fund in the heyday of European excavation in Egypt. In Adelaide its erection became a symbol of colonial pride and it stands today as a symbol of the South Australian Museum's commitment to the preservation of the Footprints of the human story. It would be fitting to celebrate this story and these meanings on the centenary of the erection of the column in its present position on 7 July 1999.

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SPIRIT BEINGS AND THE ABORIGINAL LANDSCAPE OF THE LOWER MURRAY, SOUTH AUSTRALIA

PHILIP A. CLARKE

Summary

In the historic and ethnographic record for Aboriginal culture in the Lower Murray, there is a body of mythology, on spirit beings, that does not directly relate to a creation period or as is sometimes referred to, the 'Dreaming'. Although not generally associated with land transforming events in the mythology, these beliefs are nonetheless revealing of Aboriginal perceptions of the Lower Murray landscape. This paper provides an overview of the records concerning spirit beings and adds further Aboriginal ethnographic details from the 1980s. A cultural geographical approach is adopted, which considers the role of spirit beliefs in the Aboriginal perception of place in the cultural landscape.

SPIRIT BEINGS AND THE ABORIGINAL LANDSCAPE OF THE LOWER MURRAY, SOUTH AUSTRALIA

PHILIP A. CLARKE

CLARKE, P. A. 1999. Spirit beings and the Aboriginal landscape of the Lower Murray, South Australia. *Records of the South Australian Museum* **31**(2): 149–163.

In the historic and ethnographic record for Aboriginal culture in the Lower Murray, there is a body of mythology, on spirit beings, that does not directly relate to a creation period or as is sometimes referred to, the 'Dreaming'. Although not generally associated with land transforming events in the mythology, these beliefs are nonetheless revealing of Aboriginal perceptions of the Lower Murray landscape. This paper provides an overview of the records concerning spirit beings and adds further Aboriginal ethnographic details from the 1980s. A cultural geographical approach is adopted, which considers the role of spirit beliefs in the Aboriginal perception of *place* in the cultural landscape.

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Introduction

In the anthropological literature of Aboriginal Australia, the study of mythology and its relationship to land is generally limited to the deep religious aspects of the creation period, often termed the 'Dreaming'.[1] For Australian anthropology, one consequence of this is the neglect of mythical beliefs linked to spirit beings that were perceived by Aboriginal people to have an existence separate from the 'Dreaming' ancestors. In mythology, these spirits are not 'creators', although sometimes their contemporaries, but rather co-residents of a landscape shared with Aboriginal people. This paper brings together wide ranging written sources and provides new ethnographic material for southern Australia gathered in the 1980s. A focus of the study is the investigation of how the more recent knowledge of Aboriginal people combines pre-European traditions with those that developed from relationships to a landscape altered by British expansion starting in the 1830s.

Sources And Methodology

The Lower Murray region of South Australia is the most heavily worked ethnographic area in southern Australia (Fig.1). The Aboriginal people here are generally known as the Ngarrindjeri. An outline of this diverse literature is provided in detail elsewhere (Clarke 1994, 1995). Briefly, the authors from the nineteenth century can be divided into early explorers and colonists of the 1840s (R. Penney, G. French Angas, W. A. Cawthorne and W. Wyatt) and missionaries from 1840s to 1870s (H. A. E. Meyer and G. Taplin). In the twentieth century there are anthropologists from 1918 to the present (A. R. Brown, A. Harvey, N. B. Tindale, R. M. and C. H. Berndt, P. A. Clarke), a folklorist in 1930 (W. Ramsay Smith), a sociologist in the 1970s (G. Killington) and local historians from the 1980s (R. Linn and L. Padman). Although all these recorders are influenced towards their individual social and disciplinary backgrounds, together they provide an outline of Aboriginal spirit beliefs in the nineteenth and twentieth century.

This paper provides some data from Aboriginal people interviewed in the 1980s by the author. The major Aboriginal sources were Lola Cameron-Bonney, Ron Bonney, Marj Koolmatrie, Paul Kropinyeri and Lindsay Wilson. Their information has a strong relationship to the pre-European past. Nevertheless, it also reflects the development of contemporary cultural forms through the interaction of an indigenous minority and the hegemonic non-Aboriginal culture. The sites associated with the beliefs are often

[1] See Clarke (1995) for a description of Lower Murray 'Dreamings'.

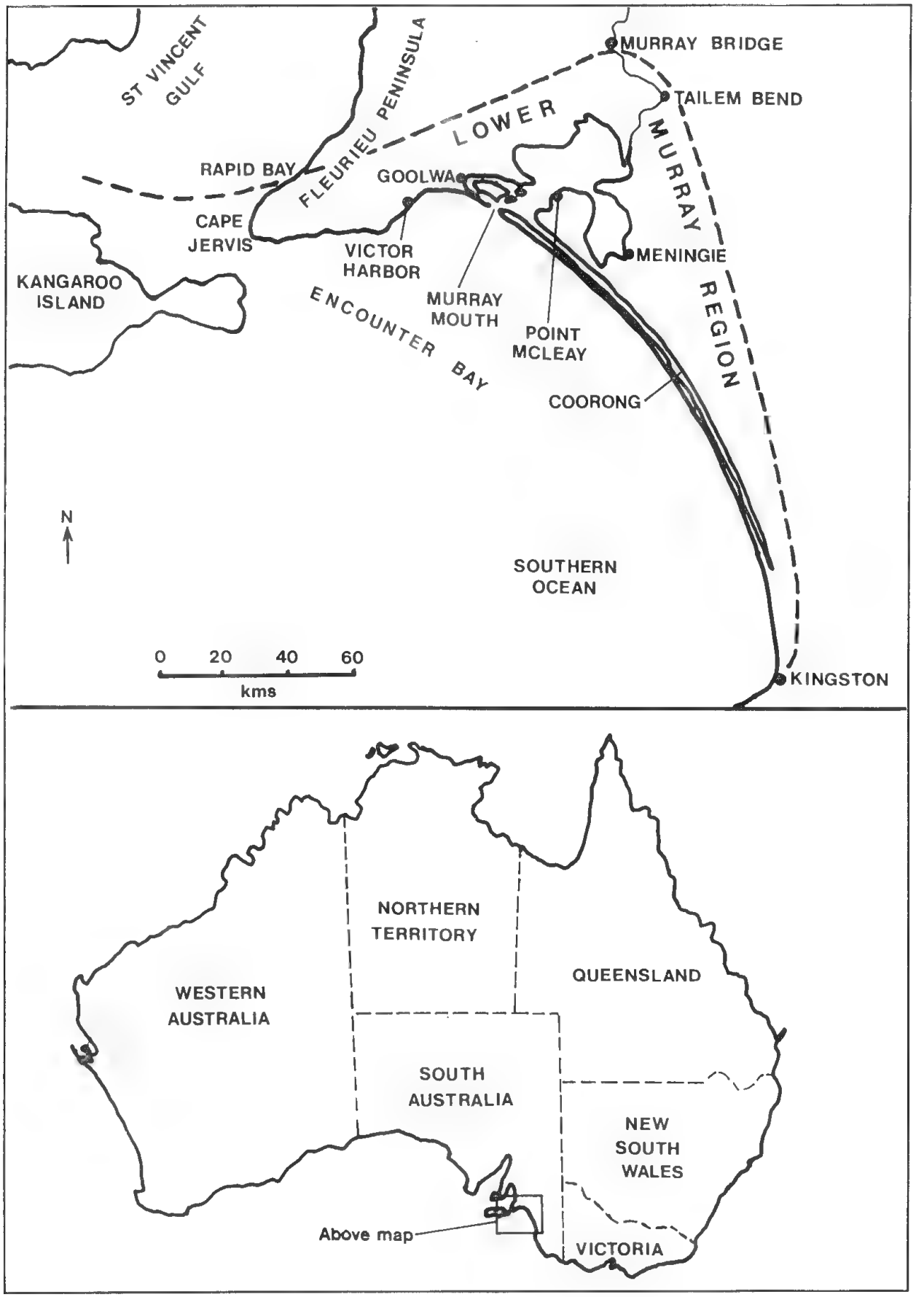

FIGURE 1. The Lower Murray cultural region.

European constructions, such as church graveyards, paths and clumps of trees left in paddocks. During the 1980s in the Aboriginal community of the Lower Murray, knowledge about spirit beings far outweighed that of 'Dreaming' stories. Non-Aboriginal forces have deeply affected the indigenous culture in the Lower Murray region. Thus traditions do change through time.

The study of how space is humanised is a major theme in human geography. How modern landscapes are produced from interaction between human populations and earlier forms of landscape is the concern of the subdiscipline of cultural geography. This paper looks at the linkages between the culture of the Aboriginal inhabitants, their use of the landscape and the perceived territoriality of the spirits. The aims therefore fall within the objectives of cultural geography.

Ethnographic Details

The use of 'spirit being' in this paper covers a wide group of disparate beliefs. Nonetheless, the unifying features are their separateness from both the ancestors involved in the main creative mythological period and the Aboriginal population.[2] Before the arrival of Europeans in Australia, Aboriginal people considered that they were co-residents of the landscape, sharing it with many spirit beings.[3] To Aboriginal people in the Lower Murray, who were probably not unique in this regard, the spirit beings and places associated with them formed distinct parts of the perceived cultural landscape. Unlike the 'Dreaming' ancestors, whose presence is indicated by what they left behind, these spirits existed contemporaneously with people.

In the 1980s most Aboriginal people in southern South Australia no longer possessed detailed information of the body of knowledge the literature has described as the 'Dreaming', but they strongly believed in various spirits.[4] Aboriginal spirit beliefs in the Lower Murray reflect the connection between group identity and *place*. Many of these spirits possessed some human characteristics and, like people, they were dispersed according to attributes of the cultural landscape. Most spirit beings were either greatly feared or at least regarded as a nuisance. Angas says:

> They are in perpetual fear of malignant spirits, or bad men, who, they say, go abroad at night; and they seldom venture from the encampment after dusk, even to fetch water, without carrying a firestick in their hands, which they consider has the property of repelling these evil spirits (Angas 1847: 88).

The term 'mooldtharp' was applied by Angas as a general term for an 'evil spirit' (1847: 96,138). He used it to mean an 'evil' species of flycatcher, an earthquake or a whirlpool. Ramsay Smith said it was 'a spirit which assumes many shapes. It may come as a kangaroo, or a wombat, or a lizard' (1930: 349). The Tangani people of the Coorong believed that the *muldarpi* were decorated and disguised men who came from the west or north to kill them (Tindale 1931–34: 165,229). To the Yaraldi of Lake Alexandrina, a *melapi* or *mulapi* was considered to be a shape changer that killed people (Berndt & Berndt 1993: 205,206). This term, written here as *mu:ldapi*, was used in the 1980s, particularly by Aboriginal people in the Lower Murray, as a term for a generalised 'bad' spirit. The following sections provide detailed information on spirit beings.

Spirit Men

Oral tradition in the local Aboriginal community was rich in stories concerning humanoid creatures that, due to their overall similarity, are described here as spirit men. The

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[2] Lower Murray beliefs concerning *gupas* and *prupi* (ghosts and spirits of local people) will be the subject of a future paper.

[3] Tindale (nd) provides an overview of Aboriginal beliefs concerning spirit beings, which he terms 'little folk' and 'little people', linking them to a 'pygmoid race'. Berndt and Berndt (1989) give ethnographic examples of 'spirit beings' from northern and central Australia. Mountford (1958: 144–159) describes the association between spirit people and land for the Tiwi of Melville and Bathurst Island.

[4] It has been reported by several authors that Aboriginal people in the southern districts of South Australia during the second half of the twentieth century had poor knowledge of their early 'traditional background'. For example, see R. M. Berndt and C. H. Berndt (1951: 197,229–233), Killington (1971: 6), Gale (1972: 13,14), R.M. Berndt (1989: 64), C. H. Berndt (1989: 17), and Berndt and Berndt (1993: 297). Hemming (1988: 192) acknowledged the lack of detailed knowledge concerning the 'Dreaming' in the Lower Murray community during the 1980s, when he claimed that of the people he consulted 'all knew only fragments' of the Ngurunderi mythology.

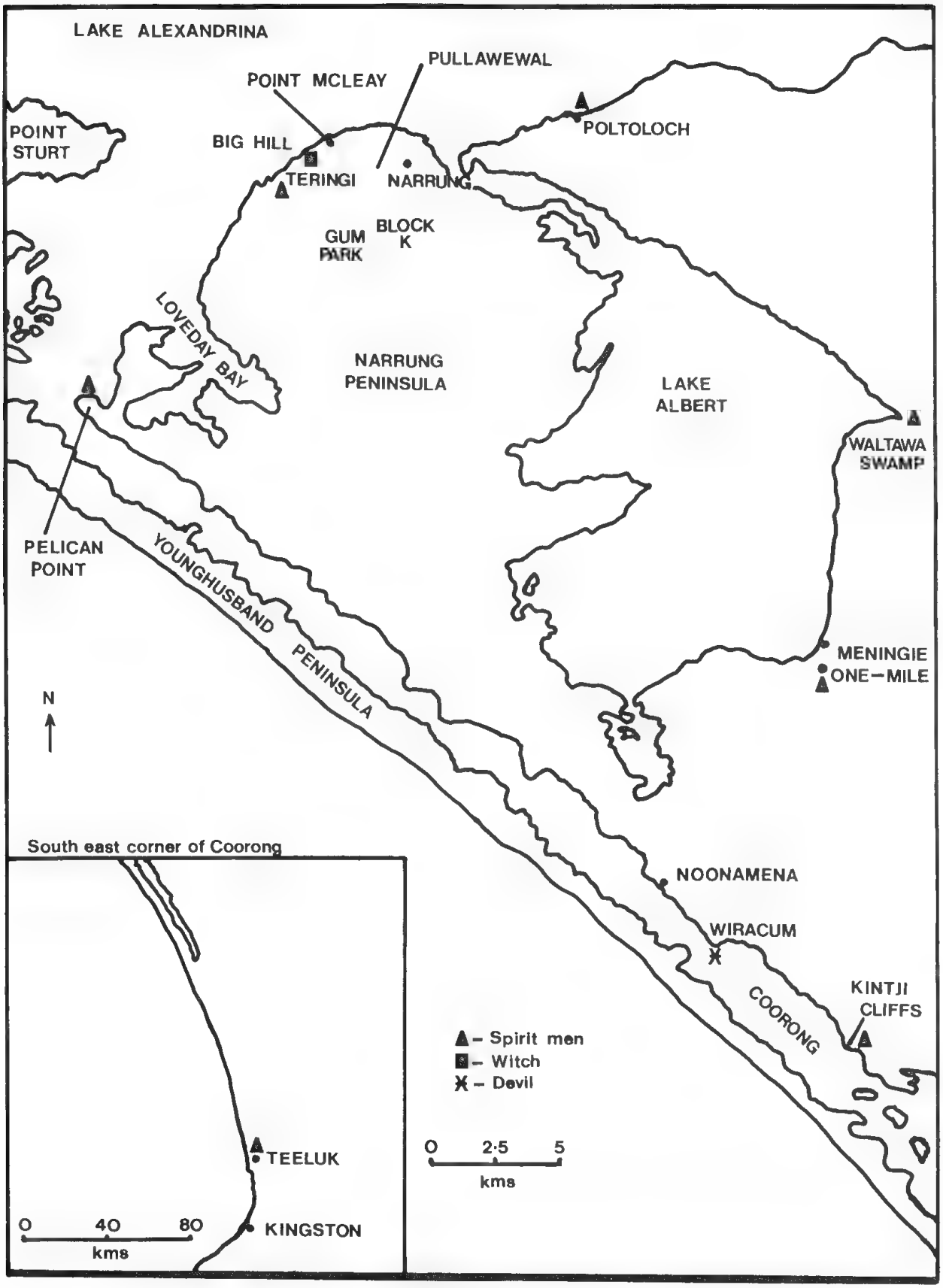

FIGURE 2. Spirit men, witch and devil sites in the Lower Murray.

shared characteristics are that they were generally described as 'coloured' (not black), often little, usually mischievous, and generally associated with a particular type of landscape. The exact relationship of this category of spirits to the pre-European system of beliefs is difficult to determine, as the ethnography has tended to ignore myths that were not concerned with the creative period.[5] In one of the rare written accounts, beings called *raitchari* were described as 'pygmy men who sometimes act as guides to hot men, sometimes lead them astray. They used to live in the scrub' (Harvey 1939). The 'hot men' are presumably people with some form of ceremonial status. It is likely that these spirit men were considered by ethnographers to have more of a fairy-tale quality than deep social or religious significance. Most of the information on these beings discussed here has been gathered from more recent sources. How spirit men were regarded is an important indicator of the degree to which both pre-European and post-European landscapes were humanised.

Although the spirit men were humanoid, Aboriginal people always described them in terms that highlight their distinctiveness from the Aboriginal population. The non-Aboriginality of spirit men was confirmed by their strange colouring and generally small size. They were often reported as being red all over, but there are many other accounts of beings in different colours. For instance, one Aboriginal person interviewed in the 1980s claimed to have seen 'little yellow men' amongst the reeds growing along the mainland side of the Coorong. Another said that 'green men' lived at Poltaloch on the southern shore of Lake Alexandrina. Another variation is 'little white men' with spiky ears, reportedly existing somewhere in the Meningie area. Adults to frighten children into obedience often used the existence of such beings.

The 'little red men' were said to have been seen at Pelican Point, Teringie and Poltaloch (Fig.2). Some people call these particular beings '*kintji* men' or '*kindi* men'. In the ethnographic record they are sometimes described as 'imps' or 'dwarf beings'.[6] A small point on the mainland side of the Coorong just south of Noonamena, known by local Aboriginal people as the Kintji Cliffs, was regarded as the home of *kintji* spirits. Another site, Kindjunga Hill near the Coorong south east of Pelican Point, was recorded as the home of *kindja* spirits who lived in its caves and amongst its rocky outcrops (Berndt & Berndt 1993: 208). These particular spirits were associated with the territory of the Talkundjeri descent group. Other places related to the *kintji* were Kentjingatung and Kintjanga, which are low sandy rises on southern Campbell Park Station near Lake Albert.[7] A sighting of a 'little red man' was reported in the 1950s alongside a swamp near the One Mile Camp situated on the outskirts of Meningie. The spirit surprised an Aboriginal man and his young son walking along a path. The man was paralysed but the boy escaped to raise the alarm. Several men from the camp came to the aid of the father who was still on his back. As with the other spirit men of the Lower Murray, the little red men were often seen in proximity to water, but believed to dwell in higher places.

Aboriginal people disagreed on the colour of the *kintji*. A Lower Murray man stated they were small white men with dark beards. Interestingly, this person knew a story that linked these spirits with the southern Eyre Peninsula landscape. He said that once the *kintji* men told an Aboriginal man at Port Lincoln that they were intending to leave the area on the first calm day. When such a day came along, they all walked in single file into a cloud of mist. It is possible that the name of the *kintji* men, if not the belief itself, originated from outside of the Lower Murray region. The term *kintji* is possibly related to *kinchirra* from the 'Nimbalda' people of the Mount Freeling area of the Flinders Ranges. The term *kinchirra* was reported by Smith (in Taplin 1879: 88) as meaning 'spirit who fetches spirits of the recent dead to the land of the west'. Similarly, *kindara*, was said to mean the 'place where spirits go' in Adnyamathanha language of the Flinders Ranges (McEntee & McKenzie 1992: 34), and *kintjura*, was the 'spirit world' in the Ngadjuri language of

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[5] Tindale (1936: 60,61) provides one of the few records of spirit people of the type described here. He mentioned 'little people' who were said, by his informants, to have lived near Marion Bay on Yorke Peninsula. Cameron-Bonney (1990: 19) provides another record from Victoria.

[6] Tindale 'Milerum' manuscript, Stage A #9, Anthropology Archives, South Australian Museum. Tindale considered that fairy penguins may have been the source of this belief.

[7] Tindale 'Milerum' manuscript, Stage A #9, Anthropology Archives, South Australian Museum.

the mid north of South Australia (Berndt & Vogelsang 1941: 9). Similar spirit beings, the *taikuni*, were said by Aboriginal people in the 1940s to have lived in little knobbed hills around the Lower Lakes, Adelaide Hills and north as far as Gawler (Berndt & Berndt 1993: 207,208).

Sightings of these spirits continued during the 1980s. For instance, a Lower Murray man claimed to have sighted two *kintji* men whilst 'swan egging' (swan egg collecting) at Waltawa Swamp, about nine kilometres north of Meningie. The spirits were apparently seen standing amongst reeds. They were described as small, light grey all over, with shoulder length hair and a long neck. Of the face, only the features of the two eyes were noticed. These were shiny black and just under five centimetres in diameter. The spirits reportedly disappeared when the person's gaze shifted for an instant. Another Aboriginal man later told him that he was lucky: it was said that when the eyes of the *kintji* are red, not black as the case in the above beings, they intend to do mischief.

There is some similarity between the 'red men' and the 'natja men' from the Tatiara district of the south east of South Australia. The *natja* men were described in the 1980s as 'red hairy men', also said to look 'like monkeys or orang-utans'. Ramsay Smith records an unlocalised story about a 'queer little red man', called 'Yara-ma-yha-who', that was reportedly told to children as a threat against misbehaving (1930: 342–345). In the 1980s another individual claimed that many years ago 'silver men' were seen on a hill near Teeluk, north of Kingston. These spirits were described as having an 'arrow-like covering' and were blamed for upsetting local cattle. The silver men eluded attempts by an Aboriginal man to capture them.

A common element to many of the accounts of spirit men is that only one or two of them were seen together, usually in swamps and lagoons where Aboriginal duck hunting and 'swan egging' activities occurred. A Lower Murray man reported 'red men' at Pelican Point earlier this century: an Aboriginal duck hunter who had disregarded warnings about these spirit men being there, shot some ducks and started to search for them in the spot where they had fallen. He then noticed a 'red man' was picking up the ducks. The Aboriginal man grabbed his gun and fled. Another story involved a Kingston man, Alf Watson, who was apparently duck hunting with his rifle when he saw a *kintji* man among the *winggi* (sagent sedge).[8] This spirit caused him to freeze and he fell on his back. The *kintji* man came up to Alf and sat on him, feeling his face with interest. This was because this type of spirit man was bearded, whereas Alf Watson was clean-shaven. Alf claimed afterwards that he could feel the *kintji* man's cold bottom on his chest through his flannel shirt. According to several Aboriginal sources, Lower Murray people who hunted in areas that were recognised as being inhabited by 'red men' used to leave one or two ducks behind for them.

Healers, Sorcerers And Wild People

Knowledgeable people, who possessed skills in both healing and sorcery, had an important role in Aboriginal society of pre-European Australia.[9] From the ethnographic accounts, it appears that a powerful person was often both a healer and a sorcerer, depending on context. It is likely that as people grew older, their perceived skills in healing and sorcery balanced the decline in their physical powers. The possession of this knowledge attracted fear and respect from other members of the community. Aboriginal people from remote groups were often suspected of being sorcerers, sometimes called 'wild blackfellows'. In the pre-European period, the fear of such beings was prompted by occasional attacks from foreign Aboriginal groups. European colonisation probably increased the fear of 'wild blackfellows' by creating categories of 'civilised' and 'uncivilised' ('wild') Aboriginal people. During the early years of European settlement in the southern districts, Aboriginal people feared 'wild blackfellows' creeping up to practice sorcery upon, or perhaps kill, them (Wilkinson 1848: 330). In the Lower Murray, Aboriginal people believed that certain celestial events foretold the coming of 'wild blackfellows' (Taplin Journals, 4–7 June 1859).

In earlier times these 'doctors' or 'sorcerers' were often people, living or dead, who were

[8] Tindale Journals, Anthropology Archives, South Australian Museum. A similar version of this account was also known by Aboriginal sources living in the South East during the 1980s.

[9] For a description of 'clever men', see Cawte (1974) and Elkin (1977).

perceived as having command over life forces and the elements of the landscape. For instance, Angas claims 'They [Lower Murray people] place great faith in sorcerers; who pretend, by charms and magic ceremonies, to counteract the influence of the spirits, to cure sickness; to cause rain and thunder, and perform other supernatural actions' (1847: 89). Sickness was generally conceived as being caused by the evil spirit of some person who had a grudge against them (Angas 1847: 96). A knowledgeable person would therefore be consulted to diagnose and correct the problem. There is a wealth of recorded material concerning the body of knowledge generally referred to in the literature as sorcery.[10] It is often difficult to separate the concepts of the healer, sorcerer and spirit being. To use exclusively any of these terms to define such people understates their role in their own culture. However, there appears to be no equivalent English term for them.[11]

In the 1980s sorcerers were generally perceived by Aboriginal people in the Lower Murray to exist only as spirit beings, not as living people or linked to anyone now deceased. They were called *kuratji* ('feather-foots') or by their original local language name, *thampamalthi*. A general fear of sorcery persisted in the community. For instance, people were careful about the disposal of their hair when it was cut, to ensure that it was not used to 'sing' them.[12] Reports of *kuratji* visitations occurred in the 1980s. For instance, according to Aboriginal people living in the South East, a *kuratji* was visiting at Woods Well on the Coorong, apparent from the 'squashed cockroach' and 'human dung' smell. Other accounts from Aboriginal people in the 1980s say the smell is *ngruwi* ('dead body fat'). The *kuratji* spirits were usually considered to be periodic visitors. When in the Point McLeay area, they were believed to stay out at quiet scrubby places, such as sections of the Block K and Gum Park farms run by the Point McLeay Aboriginal Council. Aboriginal working-men were said to be 'very careful to cover their *kantji* [urine] and *mranthin* [faeces] when out in the paddocks'. Sometimes, clearings in the bush were attributed to activities of the *kuratji*, which, in turn, were attributed to spirit beings that had 'come down from the north', possibly to punish someone. Whether sorcerers, healers and 'wild people' were human or spirit beings, what Lower Murray people knew about them in the 1980s had links to their 'traditional' pre-European past.

Witj-Witj, Witches And Devils

In southern South Australia during the 1980s, there were beliefs that some spirit creatures were once human. Such an example is the Witj-witj of the Riverland district, who reportedly was a female spirit that frightened animals away from Aboriginal hunters.[13] In her human form, she was sent away from her people for 'breaking the rules'. Another female spirit considered to be bad is associated with the Point McLeay area. Here is a place Aboriginal people call the Witches Cave in the cliffs of Big Hill facing Lake Alexandrina. Sometimes parents at Point McLeay quieten their children with threats that 'the witches will come down from Big Hill and take you away'. The Witches Cave is considered to be a dangerous place, due to the steepness of the cliff face and the friable nature of the rock. There are also other sites associated with 'bad spirits'. According to Aboriginal sources, the local name of Wirakum Point at Noonamena refers to a 'bogey man' or 'devil' (Fig.2).

The But-But Spirit

Aboriginal people in the 1980s described a being called the *but-but* as a dangerous but stupid spirit creature. It had only one arm and one leg. The 'old people' (men and women from previous generations who were knowledgeable in

[10] Most ethnographies of the Lower Murray people have some mention of sorcery practices and beliefs. For detailed accounts see Meyer (1846 [1879: 195–200]), Taplin (1874 [1879: 19,23–31]) and Berndt and Berndt (1993: 252–266).

[11] Partly for this reason, Elkin called this class of people 'Aboriginal men of high degree' (Elkin 1977).

[12] Killington (1971: 48,87) recorded from a Lower Murray person that hair was the 'trigger' on a pointing-bone, and as such was considered to have the property of being able to work into your skin, carrying with it poison. In the 1980s, some Lower Murray people believed that their own human hair, if swallowed, acted to 'spear' intestinal worms.

[13] Barney Lindsay in Education Department of South Australia (1991: 34,35) provides an account of the female spirit creature, Witj-witj. There is also a record of a male ancestor from the Murray River region with a similar name, Witjawitj (Tindale 1930–52: 303,304). These names may be derived from the European term, 'witch'.

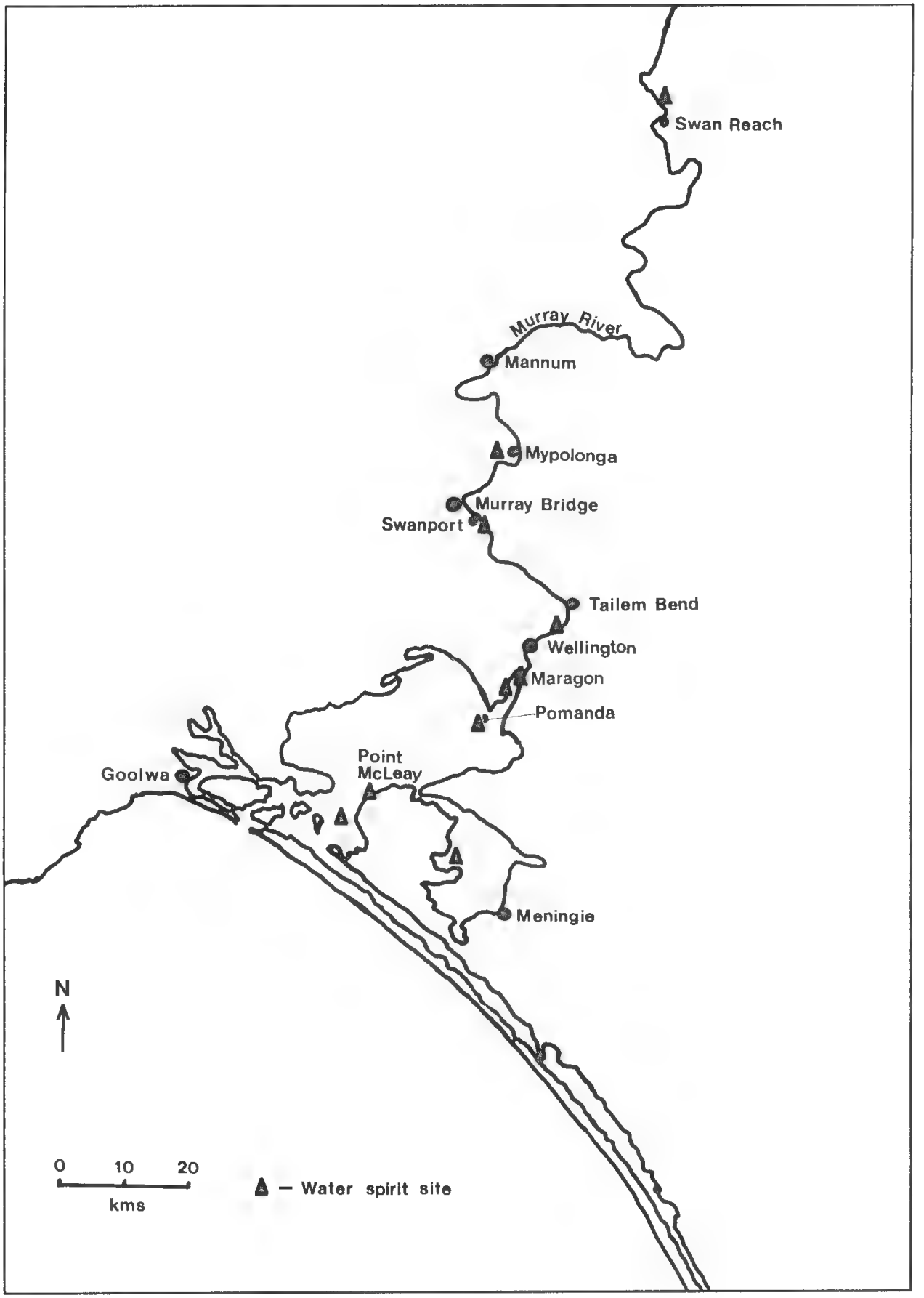

FIGURE 3. Water spirit sites in the Lower Murray.

Aboriginal tradition) apparently carried around with them bags of maggots in case *but-but* approached. If this happened, the people would lie down, putting the maggots on their eyes and mouth. This fooled the *but-but* into thinking that they were dead and passes them by. This spirit is not associated with any particular part of the landscape. The lack of sites connected with *but-but* suggests that the spirit moves randomly across the landscape, a fact that adds to its perceived stupidity.

Mulgyewonk And Other Water Spirits

Throughout south eastern Australia, there were Aboriginal accounts of water spirits, generally called 'bunyips' in the popular literature.[14] Some have been described as being animal-like, and others as predominantly humanoid creatures. In the case of the former, Aboriginal people at Moorunde near Swan Reach in the 1840s:

> believed in the existence of a water spirit, which is much dreaded by them. They say it inhabits the Murray; but although they affirm that its appearance is of frequent occurrence, they have some difficulty in describing it. Its most usual form, however, is said to be that of an enormous star-fish (Angas 1847: 97,98).

All reports by Aboriginal people in the Lower Murray feature a more humanoid-type of spirit than that recorded above (Fig.3).[15] They called the 'bunyip' of the Lower Murray, the *mulgyewonk*. This class of water spirit was greatly feared. The booming noises it made were thought to cause rheumatism (Taplin 1874 [1879: 62]). Taplin records:

> The blacks say that the Moolgewanke [*mulgyewonk*] has power to bewitch men and women and that he causes disease by the booming noise which he makes. I am now convinced that the noise does come from the lake. They say that Mr Mason shot at one over on Pomont [Pomanda] and it made him ill afterwards by its power. They say he is very much like a pungari (seal) but has a face with a menake (beard) like a man (Taplin Journals, 2–3 July 1860).

The consistent theme of most descriptions of its behaviour was the threat of capturing children who strayed too close to the edge of the lake. A Yaraldi informant, Mark Wilson, said that the *mulgyewonk* would lie submerged in the shallow waters near the edge of the lake waiting for human victims.[16] He said that its long trailing hair in the water looked like waterweed. The smell of fish and duck grease, especially when children are washing their hands in the lake after a meal is said to attract the *mulgyewonk* (Berndt & Berndt 1993: 203). Taplin was told that a man, who had rubbed himself over with oil, descended by a rope to the bottom of the lake to rescue a child captured by the *mulgyewonk* (Taplin Journals, 16–17 September 1862).[17] He managed to drag the child out from amongst the *mulgyewonk*, who were sleeping, and get back safely. Even Ngurunderi, the main Dreamtime creator of the region, was not immune to the nuisance caused by this water spirit. At the Murray entrance to Lake Alexandrina, a *mulgyewonk* tore holes in his nets, which prevented him fishing for his family (Tindale & Pretty 1980: 50). All reports of the *mulgyewonk* reinforced it as a symbol of the dangerous nature of the waters in the Lower Lakes and Murray River region.

One European resident who lived near Narrung described an incident in the 1950s or 1960s when some Aboriginal children ran to her saying there was a *mulgyewonk* in the lake. She later heard that it turned out to be a floating tree trunk with its trailing roots partially out of the water. Apparently the children had remembered their parents' warnings about the lake and the water spirit. Children are associated with both the

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[14] A general description of 'bunyip'-type water spirits is given in the *Observer*, 2 December 1893. See also Barrett (1946), Massola (1957), Hemming (1985), Ramson (1988: 109), Cameron-Bonney (1990: 16,17), Mulvaney (1994) and Smith (1996).

[15] The wormlike models of 'bunyips' that presently make up a coin-operated tourist attraction in Sturt Reserve at Murray Bridge are looked upon with disgust by many local Aboriginal residents, mainly because they do not look correct according to their own descriptions.

[16] 'The Moolgewauk' by Mark Wilson, Fry Papers, Anthropology Archives, S.A. Museum (Published in the *Journal of the Anthropological Society of South Australia*, March 1985, **23**(1): 11–16). Mark Wilson was a Yaraldi man.

[17] A closely related report is given in Wilson (cited above). See similar accounts given by Tindale (1930–52: 269,270), Berndt (1940a: 168), Rankine (in Isaacs 1980: 114; 1991: 121–123), and Berndt and Berndt (1993: 203,204). They all record that a boy is taken by *mulgyewonks* to live underwater. In a version published in a teaching manual (Education Department of South Australia 1991: 24,25), a man fishing is attacked by a *mulgyewonk*.

general story and many of the sightings. For example, in 1870, George Taplin's own son claimed to have seen the *mulgyewonk* in the lake (Linn 1988: 52).

It is likely that mounds of vegetation and earth trapped in the lake have resulted in some *mulgyewonk* 'sightings'. Before the building of the barrages, when seasonal fluctuations in the flow of the river into the lakes were much greater, large amounts of material were to be found floating there.[18] For instance, Angas says:

> Floating islands, covered with reeds, are frequently to be seen on this [Murray] river. These masses of earth, originally detached from the banks by floods or otherwise, are frequently drifted from side to side, and not a few find their way to the lake (Angas 1847: 54).

Aboriginal people reported to Taplin that they had seen the *mulgyewonk* and that one of them had died and rotted close to the shore of the lake near Rankine's ferry (Taplin Journals, 16–17 September 1862). It is interesting to note that Aboriginal people at Point McLeay during George Taplin's time attributed the booming sound of the lake to the *mulgyewonk* breaking up gumtrees, which eventually floated down the Murray (Taplin Journals, 20 June 1860). Some of these *mulgyewonk* noises were probably caused by the sudden expulsion of mud under shifting sand in the Coorong.[19] Rather than claiming that the cultural experience of the *mulgyewonk* resulted from a misinterpretation of the environment, the earlier flow conditions in the Lower Lakes and Murray River would probably have promoted more 'sightings' than now possible.

Fieldwork in the 1980s has shown that Aboriginal people associated certain sites in the river and lakes with the *mulgyewonk*. Perhaps the most widely known in the Aboriginal community was the site of George Mason's former depot on the eastern banks of the Murray, near the opening of the river into Lake Alexandrina. This place, called Maragon, was the site of many of the oral history accounts of *mulgyewonk* encounters during the last hundred years (Fig.3). Bubbles seen in the water here were considered to be proof of their existence. Several Aboriginal sources stated that there are rock holes under the cliffs at Maragon beneath the water level where these spirits lived. Understandably, for Aboriginal people swimming was not allowed at this spot. Mark Wilson's account cited above lists both Maragon and the cliffs of Pomond (Pomanda), about 8 kilometres to the south, as underwater homes for colonies of the *mulgyewonk*. Local Aboriginal people passing in canoes at night avoided the latter place, said to be their 'headquarters'. Another possible *mulgyewonk* site is Mypolonga, about 15 kilometres up river from Murray Bridge. Albert Karloan considered that this place name was possibly derived from the term *mulgyewonk* (Berndt 1940a: 166).

The *mulgyewonk* was also considered to have existed in Lake Albert and Lake Alexandrina waters. According to oral history among local European families, another site associated with this water spirit is the arm of Lake Albert. A member of a local European family claimed that Aboriginal groups for this reason avoided the area. At Point McLeay, some Aboriginal people in the 1980s remembered earlier times when the *mulgyewonk* was reportedly encountered in Lake Alexandrina. For instance, sometime during the 1940s, several elderly women, who had been fishing at the base of Big Hill at Point McLeay, hurried back to the settlement saying they had heard a *mulgyewonk* splashing a short distance into the lake. This spirit appears to have been perceived as located in all the permanent waterways of the Lower Murray (Fig.3). In the 1980s Aboriginal people in the Riverland considered that a hole in the cliff face near the site of a former mission station at Swan Reach was also the home of a *mulgyewonk*.[20] In 1952,

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[18] Aboriginal informants have pointed out several large and weathered tree trunks of dead red gums lying along the shores of Lake Alexandrina. These tree sections, of a tree species not found in this part of the Lower Murray shore, were left behind after the 1956 flood. See Hemming and Jones (1989: 1) for a photograph of one such tree trunk at 'The Bullrushes'.

[19] The water origin of the booming noise appears certain. Taplin records in his Journals (26 June 1860) that he was convinced that the booming sound originated from in the lake. He heard it 12 times in 10 minutes one evening (Journals, 20 June 1860). See other accounts by Taplin (*Register*, 30 January 1862; 1874 [1879: 62,63]). Tindale puts forward a physical explanation of the origin of the booming sound (*Advertiser*, 12 May 1936). It is possible that the advent of frequent mechanical noises in the Lower Murray, such as gun blasts, quarry activity etc., has hidden this phenomenon. Also, it is likely that the barrages at the Murray Mouth and Coorong have altered the conditions that produced the booming effect.

[20] This term is recorded in the early Lower Murray languages. Nevertheless, the term has had much wider use since European settlement. For example, a paddle steamer, based at the Goolwa end but working along the Murray River in the 1860s, was named after the river spirit, being called the 'Moolgewanke' (Taplin Journals, 26 November 1862).

Joe Mason, from the Nganguruku people, considered that the river spirit, that he called the *muldjewangk*, still lived along the Murray River at Ranginj (Devon Downs). He claimed 'I reckon it weighs 150 pounds [68 kilograms] in weight. It makes ripples on the water when it swims' (Tindale 1930–52: 313). The use of the name for this spirit here possibly reflects the movement of Aboriginal people from the Lower Murray area to the Riverland after European settlement.

Most Aboriginal people during the 1980s who claimed to have previously seen or heard the *mulgyewonk* were people who had lived at Maragon. One such man stated that he and his family observed a *mulgyewonk* in the river while they were driving across the Swanport Bridge near Murray Bridge several years earlier. This same person claimed to have found a deep hole along the edge of Lake Alexandrina when he was younger. A foul stench and a whooshing noise came from it. After describing it to his father, he was told to keep away from this area, as it was the home of the *mulgyewonk*. Another Aboriginal source claimed 'Old fellas say that whirl pools are made by *mulgyewonks* cleaning their houses.' Although the *mulgyewonk* is sometimes reportedly seen in the Lower Murray, several Aboriginal sources of this century have said it is either extinct or at least very scarce. Mark Wilson (cited above) thought that the arrival of paddlesteamers and other boats on the river caused their destruction. This opinion was reinforced by Henry Rankine from Point McLeay who gave an account of a violent encounter between a river boat captain and a *mulgyewonk* (Rankine 1991: 122). Some Aboriginal people expressed opinions that the *mulgyewonk* was a 'prehistoric remnant', and 'like the Loch Ness monster'. This water spirit was a talking point in many Lower Murray families during the 1980s.

Although the *mulgyewonk* was the main water spirit in the Lower Murray, there were also some lesser known beings. From an Aboriginal person came the following account:

> The three sisters live in the lake [Lake Alexandrina] just out from Loveday Bay. They are bad. When you are in a boat there, the first wave pushing the boat so it points the wrong way. The second makes the edge dip. The third wave fills the bottom and turns it upside down.[21]

This story was told as proof about the dangerous waters of the lake, particularly near the islands at the Murray Mouth. Several examples of white fisherman and canoeists drowning in the region were given as additional evidence. All of the information on Lower Murray water spirits reinforces the danger element of human activity on or near the waterways. This expresses the Aboriginal perception that some areas of their landscape are not safe.

Bird Spirits

Birds of one kind or another featured prominently in much of the Lower Murray mythology. In the pre-European world view of the Aboriginal people, many bird species were probably perceived as travellers between the cosmic and terrestrial landscapes, due to their ability to fly. In an early description of a spirit bird, Penney uses the term, 'muldaubie', which is a generic term for bad spirit. Penney says:

> They believe that he appears at night when the moon is up, in the evening or just before the dawn of day, in the form of the screech-owl, although he assumes occasionally other appearances. Those to whom he appears in dreams or who see his form almost infallibly die.[22]

The screeching of the 'night-owl' was considered by Lower Murray people to be a sign that something was wrong (Ramsay Smith 1930: 322). This is consistent with early Aboriginal beliefs in western Victoria where owls were considered to be used by an evil spirit to watch over people who had strayed from the camp during the night (Dawson 1881: 49,52,53). The southern stone-curlew (*Burhinus grallarius*) too, appears to have been an omen for death across southern Australia (Berndt 1940b). To Yaraldi people, hearing the call of this bird at night foretold the death of a close relative (Berndt 1940b: 460,461). Although it was no longer heard in the Lower Murray region during the 1980s, Aboriginal people could remember hearing the southern stone-curlew's call along the Coorong in the 1950s and being told that it was an ill omen.

During fieldwork, the bird spirit most commonly spoken about in the Lower Murray was the '*mingka*-bird'. The *mingka* was essentially a

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[21] Clarke (1994: 135).

[22] Penney (as 'Cuique') in *South Australian Magazine*, June–July 1842: 389–394.

night time spirit. According to one report, there were two forms of this spirit, a northern and a southern type. The northern one lived in a cave at Mount Barker. Although it ranged far, including into the south, the *mingka* returned there each night. It was described by another source as a 'sphinx-like bird', which had a human head. It came around houses at night, making a noise like a baby crying. Some people said the *mingka* could also sound like a fox. One Aboriginal account described the call as a 'shrill whistle'. Like many of the spirits already mentioned, it was a commonly used threat to make children behave. According to Tindale's Potaruwutj informants from the South East, the '*Minkar* bird is an evil being, warns about death or trouble.'[23]

It was claimed in the 1980s that in the past some old men could turn into a *mingka* at will. In the South East, an Aboriginal 'doctor' named Old Jumbuck was said to have fought with a *mingka*-bird at Bordertown. During the fight the spirit-bird repeatedly changed form, from a bird to a human, until it eventually escaped. It was reported that only Aboriginal 'doctors' could do this. One young adult explained, 'If you kill a *mingka*-bird, you must burn all of its feathers. As each feather can grow into another *mingka*-bird. It is like a phoenix in this way.' The *mingka* was said to punish people who had done something wrong. One man, it was stated, lost all but two of his children to a *mingka*-bird as 'tribal punishment'. As with the *mulgyewonk*, children appeared to be perceived as most at risk to this spirit. Children doing forbidden things at night such as crying, whistling, or even putting such objects as hats or toys on their head, was thought to possibly cause a visit by a *mingka*-bird. The spirit bird was also an omen creature. There were several accounts of people hearing the *mingka* during the night, and then being told of the death of a close friend or relative the next day. On one occasion in the 1950s it was heard calling in the scrub adjacent to a Coorong fringecamp. It thrashed about in the dark, while everybody kept inside. The next day, the children found several tops of trees, measuring over 5 cms in diameter, which had been snapped off during the night. One person claimed that her grandmother had once talked to a *mingka*-bird, which had the head of her husband's recently dead grandfather. In most accounts of this spirit it was thoroughly evil. It 'will steal a baby's breath if it hears one crying'. The 'breath' here was understood by Aboriginal sources to be the infant's spirit. The association of this bird with death was strong in all accounts.

Although the home of the *mingka*-bird was said to be Mount Barker, it was reported as seen and heard at settlements throughout the Lower Murray. Furthermore, it was said that the spirit could potentially be encountered anywhere that Lower Murray people lived. At Point McLeay, it was sometimes heard in trees on the settlement. Here, particular clumps have been pointed out as favourite roosts, such as those near the cemetery. Outside the Lower Murray area, this spirit was apparently heard in the Riverland of South Australia and one was reported as seen by a Lower Murray person whilst living in Victoria. In the 1980s, the association of the *mingka* with Lower Murray people was strong, so much so that it was virtually never mentioned in any context other than its unwanted attraction towards these people.

There are various Aboriginal names for this spirit: *mingka* was said to be a Potaruwutj language term from the South East and *merambi* the Tangani word from the Coorong (Tindale 1931–34: 228,229).[24] In the 1980s the Lower Murray name was stated to be *kowuk*, and it was described as a tawny frogmouth (*Podargus strigoides*). The spirit was also recorded as being able to assume the guise of various *ngaitji* (totemic 'friends'), such as an eagle, dog or hawk (Tindale 1931–34: 228,229). In these forms, the *mingka* carried the spirits of sinister beings, connected to their owners by *nunggi* or *kortui* described as 'like a spider web'. Men could kill these beings and the owners of the attending spirits with a 'sacred club'. Berndt suggested that the *mingka* was an owl (Berndt 1940b: 461). A Lower Murray person recorded by Killington stated that this spirit was the 'frogmouth owl' (Killington 1971: 49,50,88). Tindale said that *minkar* was the name for both the wedge-tailed eagle (*Aquila audax*) and the white-breasted sea eagle (*Haliaeetus leucogaster*) in the Potaruwutj language of the Tatiara region (cited in Condon 1955: 84). The association of large birds of prey with carrying the spirits of the dead was a common belief across Australia (Clarke 1991: 65). The Skyworld was perceived by Aboriginal

[23] Tindale vocabulary cards for the Potaruwutj of the South East (Anthropology Archives, S.A. Museum).

[24] The Tindale vocabulary cards for the Potaruwutj of the South East (Anthropology Archives, S.A. Museum) lists *minkar* as a 'being, sinister, who may assume form of totem animal.'

groups of southern South Australia as a cosmic landscape where many of the constellations were bird spirits who had travelled there from the lower land (Clarke 1996).

The association of birds of prey with the power of foresight and as vehicles for spirits is not always expressed negatively. For instance, a 1980s account states that an Aboriginal man, named Joe Lock, who had lived at the Blackford Aboriginal Reserve in the South East earlier in the twentieth century, was able to turn his 'spirit' into an eagle. One day, reportedly after he had flown about as an eagle, he was able to accurately describe a group of people travelling to the Blackford Reserve in a horse and buggy, long before they arrived. While his spirit was an eagle, his living body, which was left lying on a blanket, was not moved. In another version, it was an eaglehawk that Lock turned into while his human body was under a blanket (Berndt & Berndt 1993: 249,250). These accounts, and that of the *mingka*-bird above, indicate that Aboriginal people perceived some birds as being a vehicle for the human soul.

The *Ngout-ngout* was an individual spirit associated with birds.[25] She was reportedly once a woman who was expelled from her local group for breaking custom. For revenge, *Ngout-ngout* tricked children into becoming lost. This she achieved by using a trail of flowers to distract them. *Ngout-ngout* could turn into a bird. This story was told to children with the warning that they never wander off.

Some bird species commonly seen during the day have a similar role to the *mingka* as omens. In the Lower Murray during the 1980s the most commonly held belief in omens concerned the willie wagtail (*Rhipidura leucophrys*), *ritjaruki*. When this bird was observed persistently making strange erratic movements near a person's house, it was perceived as a message that someone had died. Tapping on a window was taken as a particularly bad sign. A variation of this belief was that when a *ritjaruki* is observed with a rusty colour on its beak, this means someone would die. One elderly Lower Murray woman living at Point McLeay in the 1980s said '*Ritjaruki*. Him good telephone at Raukkan that fella.' There were many examples of observations of the *ritjaruki* being used to forecast human death. The negative influence of the bird was made apparent when a young man at Point McLeay was said to have behaved recklessly after having accidentally run over and killed a *ritjaruki*. Since its omens were invariably considered to be unwanted, the bird was sometimes chased away. In the Lower Murray during the 1840s for instance:

> An elegant species of flycatcher, of a black colour, which continually hovers about in search of insects, performing all manner of graceful manoeuvres in the air, is regarded by them as an evil spirit, and is called mooldtharp, or devil. Whenever they see it, they pelt it with sticks and stones, though they are afraid to touch or destroy it (Angas 1847: p.96).

The ability of this bird to summon bad news appears to have been widespread elsewhere in southern Australia.[26] It is likely that the attention the willie wagtail attracts from its highly energetic movement across low and open areas, such as around houses and cars, added to the likelihood of this species being used as an omen.

There are other examples of birds being used to predict death. For instance, one Aboriginal person in the 1980s said that her mother's *nga:tji* (totemic 'friend'), a swallow (probably *Hirundo neoxena*), would fly up close to them and 'sob like a child' if someone close was dying.[27] It is likely that in earlier times, totemic species and objects would have been considered to have the power to warn people of danger or death. Another account sometimes told at Point McLeay involved a pelican, *nguri* (*Pelecanus conspicillatus*). Sometime before the 1970s, when Point McLeay was still the Government Mission Station, an Aboriginal man was out hunting near Narrung. He observed a pelican flying overhead and he

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[25] An account by Barney Lindsay is given in Education Department of South Australia (1991: 18,19). The relationship between this female spirit and male human spirits such as *Ngautngaut* of Devon Down (Tindale 1930–52: 303,304) and *Ngout-Ngout* of western Victoria (Massola 1968: 20,21) is not clear.

[26] For instance, on Yorke Peninsula, the willie wagtail was also considered to be a 'message-carrier' (Ramsay Smith 1930: 342). In the 1980s, a western Victorian Aboriginal person said that they also considered the willie wagtail to be a bad omen there. She knew of two occasions where people had reportedly died soon after seeing this bird tapping on their window. A Lower Murray informant claimed that the willie wagtail, called by them 'tjiri tjiri', as an omen, was a belief from the Portland district of Western Victoria (Killington 1971: 49,50,82).

[27] For an outline of 'nga:tji', see Meyer (1843(2): 86; 1846 [1879: 198]), and Taplin (1874 [1879: 1]; 1879: 131).

raised his gun to shoot it. Pelican flesh is considered bad eating but the feathers were used in ornament making. Nevertheless, the bird was acting strangely so it was not shot. The pelican flew several times over the man's head and then out over Point McLeay and across the lake towards Adelaide. This was interpreted as a message that the man's brother, who was known to be in an Adelaide hospital, had just died. The story concludes with the later surprise of the Mission superintendent, who had come down to the man's house with the message of the death, at being told the family already knew.

The ability of birds to fly and the more frequent observation of them made them more suitable than other land-based animals as omens. The specific behaviour of certain species, such as the willie wagtail, seems to have been a major factor in their designation as message carriers. The night time activity or the ability to fly high were probably important characteristics in the identity of other spirits. For other birds, peculiar behaviour on single occasions was interpreted as a sign. Although much of the folklore formerly known by Aboriginal people was lost or significantly altered by the 1980s, the Aboriginal practice of seeking information from signs in the environment persisted.

Cultural Significance Of Spirit Beings

The Aboriginal cultural landscape of the past was imbued with meaning, not just with the topographical reminders of the actions of creative 'Dreamtime' ancestors, but by the perceived occupation of spirits. As with biotic organisms, such as plants and animals, these beings were considered to exhibit particular spatial behaviours. With a few exceptions, the spirits exhibited their own territoriality. The beliefs in spirit beings contain encoded knowledge about the landscape, particularly about dangerous places and the movements of human spirits after death. Many of the accounts given in this paper either relate directly to children, or concern the actions of beings that could be used as threats by adults to help control the behaviour of them. Other spirits served as omens, providing a means by which Aboriginal people could make predictions on the future. Fundamental to many of the beliefs is the Aboriginal notion of a person's spirit surviving death and being able to be summoned and carried away by spirits. In some contexts, most of the spirits discussed in this paper could be termed as *mu:ldapi*, stressing their potentially negative impact upon the lives of Lower Murray people.

Twentieth century Aboriginal culture in southern Australia has often been described in sociological rather than cultural terms. There are nevertheless elements of the pre-European world view that have persisted here. During the 1980s, beliefs in spirits, albeit in greatly modified form, served to 'explain' the rural landscape in a manner that relates to how they probably explained the pre-European landscape. Aboriginal people also derived some enjoyment in these beliefs as stories. They were also important as signifiers used by Aboriginal people in the Lower Murray to express their regional identity. By engaging in the discussion of the activities of spirits as fellow occupants of their land, Aboriginal people were highlighting their identity with respect to the local landscape.

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'FINCH' VERSUS 'FINCH-WATER' : A STUDY OF ABORIGINAL PLACE-NAMES IN SOUTH AUSTRALIA

LUISE A. HERCUS AND VLAD POTEZNY

Summary

This paper discusses the causes that underlie the geographical distribution of names ending in -owie and similar water-related place-names. The authors draw on the place-name research of N.B. Tindale and on their own fieldwork, and correlate the place-naming conventions in South Australia with the known linguistic data. They suggest broad conclusions relating to linguistic development and diffusion within the region. The patterning of water-related place-names suggests that linguistic diffusion has interrelated with, and in many instances overcome, the strongest genetic links.

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This paper discusses the causes that underlie the geographical distribution of names ending in -owie and similar water-related place-names. The authors draw on the place-name research of N. B. Tindale and on their own fieldwork, and correlate the place-naming conventions in South Australia with the known linguistic data. They suggest broad conclusions relating to linguistic development and diffusion within the region. The patterning of water-related place-names suggests that linguistic diffusion has interrelated with, and in many instances overcome, the strongest genetic links.

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Introduction

Finches love to congregate around water, and so it is not surprising to find sources of water called after them. The best known of these is Ediowie *Idhi-awi*[1] 'Finch-water' in the Flinders Ranges. Further north on the western side of Lake Eyre in Arabana country there are two places simply called *Yatyapara-nha* 'Finch': the final *-nha* is the optional proper noun marker used in Adnyamathanha, Kuyani, Arabana and other languages to the north. One *Yatyapara-nha* is the Tarlton spring near the headwaters of Hope Creek, the other is Lethbridge Spring, near the Paisley Creek, and hence the name serves also for the Paisley Creek. There is at first sight nothing remarkable about this, except that on closer investigation we find that there are simply no place-names ending with the word for 'water' in Arabana country, nor in the areas where Diyari and closely related languages were once spoken. Place-names follow the pattern of 'Finch' or 'Finches' (no distinction is made between singular and plural unless this is to be emphasised), rather than the 'Finch-water' of the more southerly areas. In this paper we attempt to show the extent of this regional distinction and to examine further implications. The names under discussion only represent a fraction of the totality of place-names in the area, because throughout there are many names that are not descriptive at all. Place-names can be formed in all kinds of ways and may even consist of verb-forms referring to events in myths. An example of such a name from Wirangu country is 'Cungena', the name of a small railway township to the east of Ceduna, based on an original *Wiyana-gandyina* "(they) kept hold of the woman'; *gandyina* is the past tense form of the verb *gandyirn* 'to keep hold of'. Although the descriptive names for sources of water are definitely not the rule and do not represent the whole picture, they do nevertheless give some linguistic insights. N.B. Tindale's own manuscript notes suggest that he was intrigued by the distribution of the 'awi' place-name suffix as long ago as the 1930s. In fact, this interest may have been a contributing factor to his enduring research interest in Aboriginal place-names, which continued until his death in 1993.

In the part of South Australia that we are discussing there is one major closely linked language sub-group. These are the Thura-Yura languages, from the word for 'man' in some of them. These languages are listed here, with a rough indication of their location, based on Tindale 1974.[2]

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[1] Words that are based on modern linguistic transcriptions are given in italics.

[2] This paper is not intended to make any detailed statement regarding the attribution of country to one group or another: it deals with the formation of names.

Kaurna	Adelaide area.
Narangga	Yorke Peninsula.
Ngadyuri	Peterborough area.
Nukunu	Southern Flinders Ranges, and from Crystal Brook to Port Augusta.
Parnkalla	Eyre Peninsula and adjacent areas to the north.
Nauo	Southern Eyre Peninsula.
Adnyamathanha	Northern Flinders Ranges.[3]
Walypi	Blinman area, closely associated with Adnyamathanha.
Kuyani	the plains to the west of the Flinders Ranges and Stuart Creek country.

an outlier of this subgroup is:

Wirangu	on the West Coast of South Australia and originally inland beyond the railway line.

Nearly all the Thura-Yura languages use the 'Finch-water' type of place-name.

To the north of this area languages of the Karnic subgroup were spoken: these include Arabana from the west side of Lake Eyre, Thirrari, Diyari, Pirlatapa, Yandruwantha and Yawarawarrka from the Cooper and the far north-east of the state. The language spoken to the east of the Northern Flinders Ranges was Yardliyawara: this was closely related to Wadigali from the Yandama Creek and to Malyangapa in adjoining parts of New South Wales. Further south were Wilyakali and Thangkali, which belong to Paakantyi, the Darling River language group. All these languages use the 'Finch' type of place-name. The word for 'water' is never added to the end of a place-name, not even optionally. Within South Australia it is basically the Northern Flinders Ranges and an area from the Western Australian border to Olary that contains numerous place-names of the 'Finch-water' type.

-Awi 'Water'

In Adnyamathanha country

The word for 'water' in the Thura-Yura languages is *kawi,* but when this is added to another word to form a place-name the initial *k* of *kawi* is usually lost. In the Adnyamathanha language of the Northern Flinders Ranges initial *k* is lost altogether, and 'water' is '*awi* ' anyway. The final vowel of the preceding word is usually lost before *-awi* : this seems to be the case even with *-i*[4] and *-u* , eg. *Wartuli-awi >Wartul-awi.* This rule applies in Parnkalla and Nukunu too, hence Marachowie 'Marrity'awi' from 'marrityi + awi' and Tandowie 'Thand'awi' from 'thandu+ awi'. There are some exceptions which will be noted in the relevant sections. The term *-awi,* usually rendered as 'owie' in English spelling, appears to be used at the end of many, though by no means all relevant place-names as a kind of classifier, showing that the locality is a source of water, or associated with a source of water; so a creek or even a nearby hill can be named from a spring or waterhole.

The use of *-awi* in place-names is most conspicuous in the Northern Flinders Ranges in Adnyamathanha country. Some of the names of springs or soakages (now often made into bores and wells) in the Flinders have names ending in *-awi.* These names are numerous and we give just some examples. The explanations, unless stated otherwise, are all based on McEntee and McKenzie (1992) and on personal communications from John McEntee:

Italowie Creek, Gorge and Spring *Itarl'awi,* from *itarla* 'a crack in rocks'; in the Gammon Ranges.

Wilkowie Well	*Wilk'awi* 'Dog Water'; just north of the Flinders, on the Strzelecki Track.
Arrowie Spring	*Arr'awi, Arr'awi-nha,* 'High Water' (McEntee & McKenzie 1992: 11), but Tunbridge 1988: 98 analyses this as *Arru-awi;* north of Mt Chambers.
Weetowie Waterhole	*Urt'awi,* 'Black Tea-tree Water; close to Arrowie, north of Mt Chambers'.
Wirrapowie Spring	in Bendieuta Creek, possibly *Wirup'awi;* 'Cockatiel Water' (J. McEntee, pers.com.).

[3] Tindale (1974) uses the name 'Wailpi' for all the people of the Flinders Ranges.

[4] There do not appear to be any Adnyamathanha, Nukunu or Parnkalla examples of a final *-i* in disyllabic words preceding *-awi*; there is however the nearby case of Busheowie (see under Kuyani below). We use an apostrophe to indicate vowel elision.

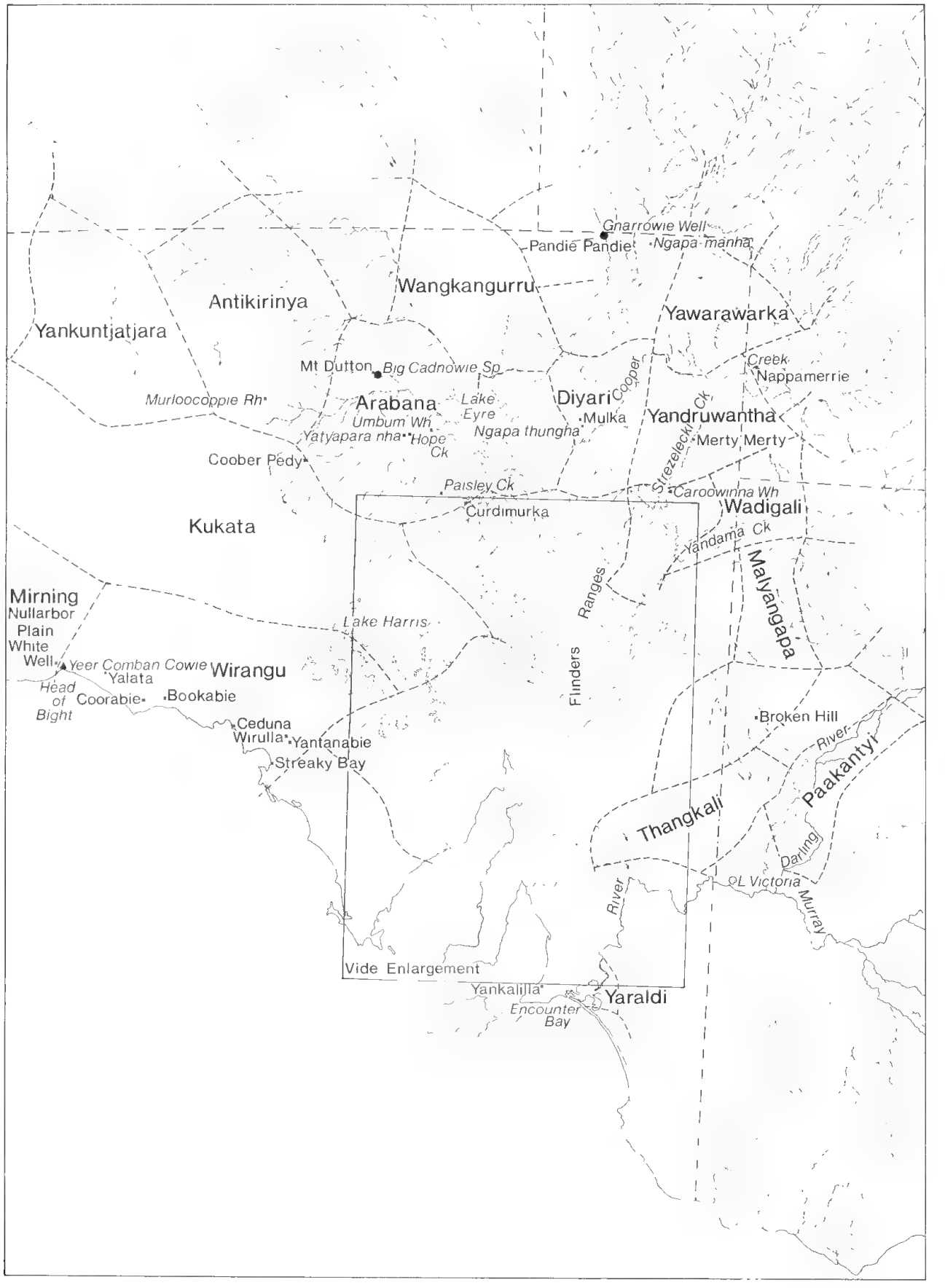

FIGURE 1. Distribution of Aboriginal language groups in southern South Australia.

Waterlowie Bore	*Wartul(i) awi* 'Ringnecked parrot Water'; near the north-eastern edge of the Flinders Ranges.
Wepowie Mine	*Wip'awi* 'Ant Water'; north-east of Parachilna
Boudowie Well	derivation unknown; near Burr Well.

Tunbridge (1988: 92 ff.) relates the myth of the 'Two Mates', the Cross-Cousins *Wartalyunha* and *Yanggunha* 'the Left-handed one' who created some of the springs and waterholes in the eastern Flinders Ranges. This myth, among others, gives the background to a few of the *-awi* names:

Ungoonya Spring	*Yanggunh 'awi* 'the Ancestor[5] *Yanggunha* Water' (Tunbridge 1988: 171).
Wertaloona Spring	*Wartalyunh'awi*, 'the Ancestor *Wartalyunha* Water' (Tunbridge 1988: 169,171).
Nepoui Spring	*Nhip'-awi* 'Flat rock Water'.
Arcaroola Springs	*Akurr-ul'-awi* 'the Arkaroo-serpent-stretched-out Water'.
Wattle spring	*MatyrarraRinh'awi* 'Filmy Water'; near Mt Chambers.

There are some names in Adnyamathanha that always contain *-awi,* but this final is sometimes omitted in names on maps, such as *Pinth'awi* Pinda Springs, 'Pay-back Water'; west of Mulga View in the Northern Flinders Ranges. Because Adnyamathanha vocabulary is well recorded and there are still speakers, it is possible to interpret most of the names. The difficulty of interpreting names, if there is no traditional information , and if they are known only through English spellings, is shown by the following:

Moorowie	*MuR-awi,* well near Mt Chamber, 'Thirst-water', in Adnyamathanha country.
Big Moro Gorge	*Mur'awi*, 'Ancestor water' from the word *mura* 'Ancestor'. *mura* in Adnyamathanha is also the name of a small goshawk, but traditional information, recorded by John McEntee shows that the derivation was from *mura* 'Ancestor' (J. McEntee, pers.com.).

We know only through the evidence of Adnyamathanha speakers that there are totally different derivations for Moorowie and Big Moro Gorge. The two names are unconnected, they are associated with two words that are distinguished from each other by having a retroflex -R- and a front tapped -r- respectively.

There is a third place with a similar name, 'Moorowie', a dam south of Manna Hill, in Ngadyuri country. As there are no Ngadyuri speakers, we do not know whether it was once *mura* or *muRa.* Moreover, in the absence of traditional information, we do not know whether, if it was *mura*, it meant 'Ancestor' or 'goshawk'. There is an entry for 'mura', 'goshawk' in the Ngadyuri vocabulary by Berndt and Vogelsang (1941), but this does not prove anything for the place-name.

In Parnkalla country

There are a few of the typical -owie names in Parnkalla country. It is not possible to interpret them with any certainty whatsoever, but attempts can be made thanks to the brilliant work of Schürmann 1844 and with the help of comparative data:

Marachowie Spring	'Marrity'awi', (from 'marritye', 'cat'), 'Cat Water'; near Yadlamalka, north-north-east of Port Augusta.
Belcherowie Well	'Paltyarr'awi', 'Rat Water' (from 'paltyarra', 'rat'); near the Moralana Creek and close to the eastern edge of Lake Torrens.
Yeltacowie Creek, and Lake	'Yalta-kawi', 'Crack (in rocks) Water', parallel in meaning to the Adnyamathanha place-name 'Italowie'; near the northernmost edge of Pernatty Lagoon.
Manucowie Wells	'Manu-kawi', 'Back Water'; south-east of Bookaloo. Both this name

[5] Tunbridge uses the term 'heroes' to refer to mythological Ancestors.

and the preceding are unusual in that they show preservation of the initial k-sound of *(k)awi* 'water'.

Etowie Creek. 'Irt'awi', 'Bird Water'; near the eastern side of Lake Torrens; south of Moralana Creek.

Nonowie this could perhaps be 'Nanna+awi', 'Bad Water'; near Whyalla.

Billabowie meaning unknown, near Kyancutta.

Some *-abi* names too can be found on upper Eyre Peninsula, such as Currabie near Mt Wedge and Carappee south-west of Kimba, both of which probably represent 'Kar'abi' 'Grassy plain Water', and Moonabie (possibly 'Munna-abi', 'Chest Water'), south-west of Whyalla. These -abi names are based on 'kapi' which is quoted by Schürmann as an alternative word for 'water' in Parnkalla.

In Nauo country

There are some interesting placenames of this kind in the far south of Eyre Peninsula which would indicate that Nauo shared in this development, using only -awi. The names in -abi do not appear on western Eyre Peninsula till just south of the latitude of Venus Bay in Wirangu country, with Chintabie, Courtabie, Warrapie, Moyappie and Thulinippie. The more southerly and presumably Nauo names are:

Mungerowie between Port Lincoln and Coffin Bay.

Woolawae some 15 km north-east of Coffin Bay.

Titjowie Dam about 15 km south-east of Lake Giles Conservation Park.

Most interesting of all is:

Wepowie some 25 km north of Coffin Bay, 'Ant Water'. This is identical in formation to the Adnyamathanha Wepowie, *Wip'awi*, 'Ant Water'. north-east of Parachilna, and to Wepowie north-east of Booleroo Centre in Nukunu country (see below), and also to Weebubbie, probably *Wiba'bi* 'Ant Water' near Eucla.

In Nukunu country

There is only limited information available on the Nukunu language, mainly from Gilbert Bramfield (Hercus 1992). Even with the use of comparative data it is not possible to analyse most of the place-names. The following are some examples:

Warcowie is now pronounced *Wark'awinha* by Adnyamathanha people (McEntee & McKenzie 1992), but as it is by the Warracoo Creek it is likely to have been based on a Nukunu form *waraku* + *awi* 'Long Water'.

Winninowie Creek possibly based on the Nukunu equivalent of Parnkalla 'winninya', 'dry grass' hence 'Winniny'awi', 'Dry grass Water'; between Port Augusta and Nectarbrook.

Ulalowie Hut derivation unknown, west of Kanyaka.

Capowie Creek possibly 'Kap'awi', 'Marrow Water'; near Quorn.

Willowie there is a remote possibility that this is connected with a Nukunu equivalent of Adnyamathanha *wirlla* 'lizard'; near Melrose.

Wepowie 'Wip'awi', 'Ant Water'; north-east of Booleroo Centre.

Tarcowie derivation unknown; south-east of Booleroo Centre.

Telowie Creek 'Thilh'awi', 'Thorny Saltbush water'; between Port Pirie and Port Germein.

Tandowie this name is probably 'Thand'awi', 'filled up (waterbag)', (J. McEntee, pers.com.), from 'thandu', parallel to the Ngadyuri *Yand'awi* , from *yandu* 'filled up'; listed below. In Nukunu lenition of initial consonants does not occur, hence an initial *th* does not change to *y*; south of Wirrabara.

Milcowie Dam derivation unknown; north of Crystal Brook.

Not found on maps, but recalled by Gilbert Bramfield:

Kariyawi 'Emu Water', spring south-west of Mt Remarkable. This

	name is exceptional in that the final *-i* of *kari* 'emu' is not elided.
Pinthawi	spring behind Port Germein, probably 'Pay-back Water' like Pinda Springs in Adnyamathanha country.

The following places were probably in Ngadyuri rather than Nukunu country:

Yandowie Mine	probably '*Yand'awi*' from *yandu*; 'loaded up, filled', referring to a waterbag. The name is associated with a myth (Tunbridge 1988:54) in which during a drought an Ancestor comes from Curnamona chasing a kangaroo, and from its skin he ultimately makes a waterbag (J. McEntee, pers.com.); west of Baratta.
Bucketowie Hill	possibly 'Pakart'-awi', 'Sore Water', north-east of Craddock
Wongowie Bore	derivation unknown; close to Bucketowie Hill.

These are the most north-eastern of the *-awi* names in the Southern Flinders: further north-east is Yardliyawara country, where place-names ending with the word for 'water' are not found.[6]

In Ngadyuri country

Information on the Ngadyuri language is limited, confined mainly to a comparative word-list with Diyari, published by Berndt and Vogelsang (1941). The *-awi* place-names are very common in Ngadyuri country. Examples are:

Wilcowie	'Wilk'awi', 'Dog Water'; north of Belton.
Buckalowie Creek, Hill, and Bagalowie Bore	'Pakal'awi ', 'Frost Water'; north-east of Belton.
Canowie	'Kany'awi', 'Stone Water'; south-east of Jamestown. The Ngadyuri word for 'stone (in a creek')' is written as 'gunja' by Berndt and Vogelsang 1941. This name is exactly parallel to *Kadnyawi* quoted below.
Yardlowie Well and Hill	This name could possibly be connected with the Adnyamathanha word *yardla,* 'pointed hill'; near Manna Hill.
Caltowie	'Kalt'awi', 'Sleepy Lizard Water'; west of Jamestown.
Dillowie Creek	probably the same as Telowie in Nukunu country, 'Thilh'awi', 'Thorny Saltbush Water'; south-east of Jamestown.
Booborowie	derivation unknown; north-west of Burra.
Bimbowrie Creek and Hill	'Pinp'awi', 'Murray pine Water'; north-north-west of Olary. This was probably at the border of Wilyakali country.

Wilyakali belongs to Paakantyi, the Darling River language group, and like the other Darling River languages it does not have place-names of the 'Finch-water' type. There are therefore, apart from the exceptions discussed below, no more names in *-awi* further to the east, nor any formed with the Paakantyi equivalent which was *nguku.*

In Narangga country

Narangga country basically comprised Yorke Peninsula as far north as about Port Broughton, where it adjoined Nukunu country. The most important information on Narangga, and particularly southern Narangga country, comes from Louisa Eggington who talked to T. Howard Johnson between 1898 and 1900 (published 1930–1931). Fortunately she also spoke many years later with Tindale. His work (1936) contains a vocabulary and summaries of some myths. Many of the place-names, particularly names of waterholes, end in *-awi.* There was a variant form 'kapi' for 'water' in Narangga (Tindale 1936: 61), just as there was in Parnkalla. This was attested earlier by Sutton (1887–1888) who writes 'cabbie', 'water'. Some of the most interesting examples of place-names given by Tindale are the following:

Hilderowie Well	'Ilar'awi', 'Dwarf Water', from mythical beings called

[6] Interestingly enough the word *ngapa* 'water' does occur in final position, not in a place-name but in the name of a group, the *Malya-ngapa* 'Salt-lake water' people of far western NSW, who were closely linked to the Yardliyawara.

	'ilara' who once dwelt there. Their camps are said to be still there as mounds; near Marion Bay.
Coobowie	'Kup'awi', 'Ghost Water'; just north of Edithburgh; for 'kupa' 'white' see below under Murloocoppie.
Pondalowie	'Pantal'awi', 'Limestone Water', (probably 'parntal'awi', cf Adnyamathanha *varnda* 'limestone', the *-l-* being probably explicable as an epenthetic consonant); near the south-western tip of Yorke Peninsula.
Woorowie, Big Scrub Hut	'Wurawi', derivation unknown.
Goonderowie, Dust Holes	'Kundar'awi', 'Bad Water', according to Tindale probably connected with *kudna* 'excrement', a word still recently recalled by Narangga people; south of Daly Head.

It appears that in Narangga, as in Wirangu, the *-a-* of *-awi / -abi* was elided, rather than the final vowel of the preceding word. There are no examples of *-awi / -abi* with words ending in *-u*, but this feature can be seen clearly with two words ending in *-i:*

Calloway	'Kali'wi', 'Dog Water'; near Daly Head.
Carriebie	'Kari'bi', 'Emu Water', near Black Hill Conservation Park.

Sometimes, however, the word for 'water' remained unchanged, maintaining its initial *k* , as in:

Orrie-cowie	'Nguri-kawi', interpretation suggested by Tindale, but meaning unknown; west of Warooka.
Bubla-cowie, Bubladdowie	written as 'Bablikawi' and 'Babladawi' by Tindale, with the interpretation 'where young men are circumcised'. Presumably the term is cognate with Kaurna 'pappa', 'young initiate'; west of Weaver.

Wirangu

The Thura-Yura word kawi 'water' existed also in the Wirangu language of the West Coast. It is attested in the earliest known vocabulary there is, that of Eyre. He writes (1845):

kau-we, gaip-py—water.

The term 'kawi' is found in the name of the important Ilcumban well near the Head of Bight, 'Yeer Comban Cowie', recorded by Eyre (1845: 240). The spelling 'gaip-py' no doubt represents gabi/kapi. This was either a very early borrowing from Kukata, or it existed all the time in Wirangu. Parnkalla similarly had two forms, both attested by Schürmann (1844) and the same situation existed in Narangga (see above). The names of many other rockholes in Wirangu country end in *-abi*. The rules for attaching *-abi* are as in Narangga, with loss of the initial -a- of *-abi:*

Examples are:

Bookabie	*Buga'bi*	'Stinking Water'.
Coorabie	*Gura'bi*	'Magpie Water'.
Cundilippy	*Gurndili'bi*	'Auntie Water'.
Hasting's place	*Mumbulu'bi.*	
Korgabie	*Gurga'bi.*	
Possum rockhole	*Birlda'bi*	'Possum Water'.
Walpuppy Well	*Walba'bi,*	'Hill Water'.
Puntabie	*Barnda'bi*	'Rock Water'.

Other examples, with meanings that are not certain are:

Yantanabie	on the highway, south-east of Wirrulla.
Alcannabie	just south of Streaky Bay.
Gilgarabbie Bore	south-west of Nullarbor Plain.
Waltanabie Tank	near Yalata.
Nalanippie	south of Nundroo.
Waltabie Well	*'Waltha'bi'* (var. *Waltya'bi)* 'Eaglehawk Water'.
Wiltabbie Well	*Wilth'abi* (probably var. of *Wilty'abi*) 'Old Water', near Wilgena.

There are various other spellings for the same final, notably ' -bee' and '-ppy:

Walenippi tank	north-east of Smoky Bay.
Jumpuppy Dam	close to Walpuppy, south-west of Lake Gairdner.
Arcoordaby Rockhole and Well	west of Lake Harris.
Peelanibbee Water	north of Head of Bight.

The easternmost of these names is Mintabie Well, west of Lake Hart, *Minta'bi* 'Round Water,

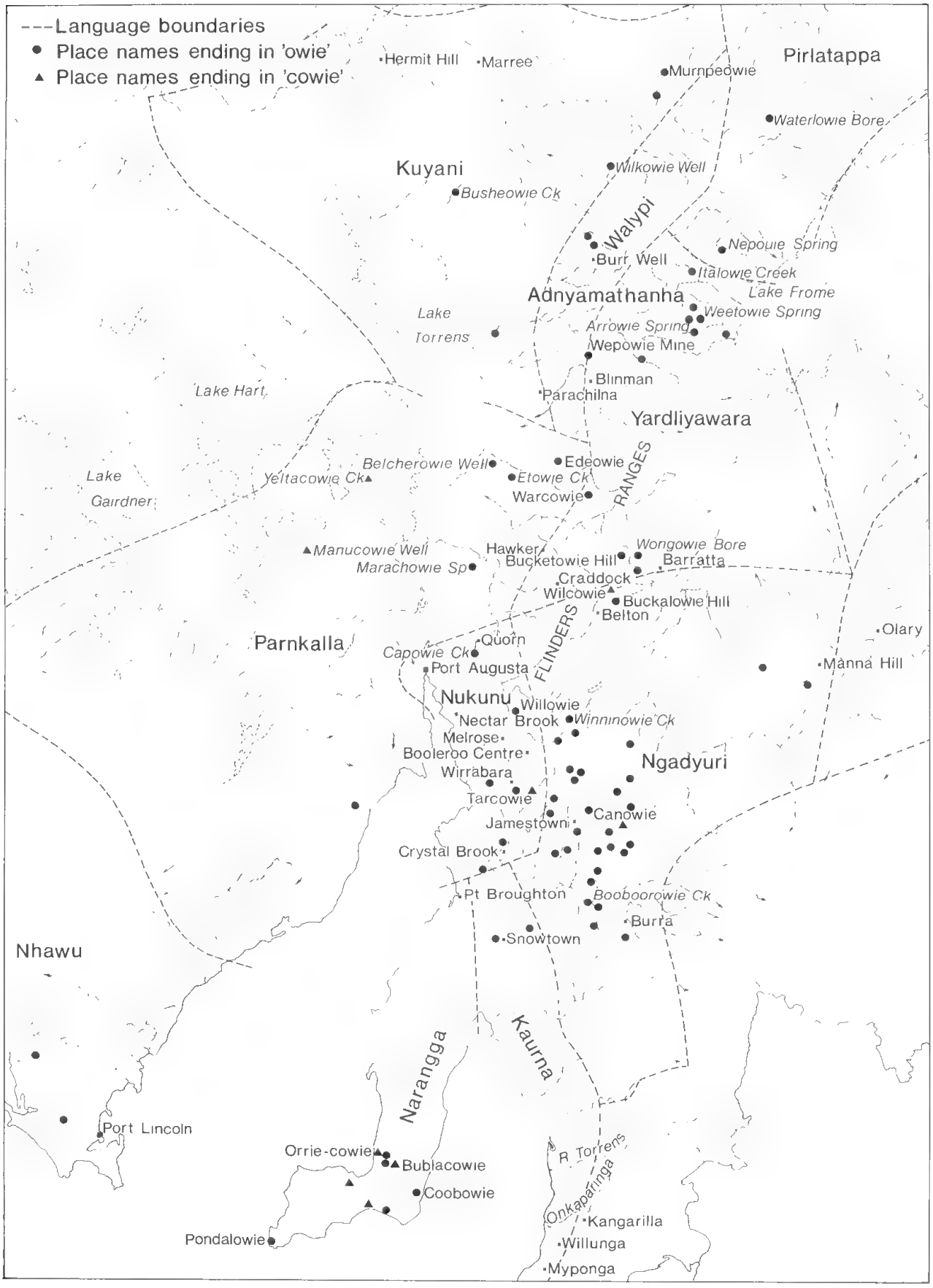

FIGURE 2. Distribution of '-awi' place-names.

lit. 'Navel Water'. This is distinctly a Wirangu name, as Parnkalla has assimilation of 'nt' to 'nn', and therefore *minta* is represented by 'minna' in Parnkalla.

There are a number of names in *-(a)bi* in the area along the coast between White Well and Eucla on the Western Australian border, an area which had no permanent water and was probably only sporadically used as a hunting resource by Wirangu people from the east and Mirniny people from the west. This becomes clear from a study of historical sources, particularly Daisy Bates, carried out by Tom Gara (Gara & Cane, MS.). People also came to the great quarry near Wilson's Bluff and for ceremonies in the area.

Mallabie Tank	possibly *Malya'bi* 'Mud Water'; to the west of White Well.
Cundalabbie	further west from Mallabie.
Yangoonabbie Tank and Bore	*Yangguna'bi*, 'Cockatoo Water'; half-way between the Head of Bight and Eucla.
Bunabbie Blowhole, Rockhole and Tank	probably *Barna'bi*, 'Goanna Water', close to Eucla.
Weebubbie	probably *Wiba'bi* 'Ant Water' near Eucla. This cave with a spectacular underground pool appears to be the westernmost of this continuous series of names.

These are all Wirangu names, not Mirniny: *yangguna* is the Wirangu word for 'cockatoo'. In Mirniny the word for 'water' was 'midyal', and it does not appear to have been used as a common feature of geographical names, neither were *midhal* and *kabi* in the neighbouring and closely related Ngadyumaya language (von Brandenstein, 1991: 160–163). The Eucla area thus represents the westernmost extent of the bulk of the *-awi* and *-(a)bi* place-names, though there are a few isolated names in *-(a)bi* further west. Daisy Bates's manuscript gives place-names between Eucla and 'Madhuru' (Madura), and there are just three of these names, all referring to 'waterholes in gullies along cliff sides': Kallalabi near Eucla, 'Kalliabi' (this is clearly another 'Emu Water') and 'Jillong Gabi'. These may well have been formed under the influence of the Wirangu method of naming.

Far-Flung Place-Names

Of the numerous Australian place-names ending in -owie there are isolated examples in areas far distant from Thura-Yura country, and in these cases it is usually quite obvious that they have nothing to do with the Thura-Yura word for 'water'. Typical of such place-names is Nowie in Victoria and associated sites nearby such as the Nowie channel. The derivation of this place-name is known: it comes from the word *Nyawi* 'Sun' in Wembawemba and related Kulin (Victorian) languages. The only conspicuous set of place-names is from Gumbayngir country, on the edge of the New England tablelands. These belong to presumably a quite different derivation. The references are:

Willowie Creek stream	29 17 152 22 SH5606 9339 NSW.
Coolowie homestead	29 58 150 23 SH5605 8938 NSW.
Koukandowie Creek	stream 29 54 152 51 SH5606 9438 NSW.
Koukandowie Mountain	mountain 29 59 152 52 SH5606 9438 NSW.

The Gazetteer shows that a few homesteads, from Western Australia to Tasmania, that have names in -owie, which may reflect the presence of homesick South Australians.[7] Here we discuss only those names that are clearly relevant: they look as if they could be Thura-Yura names, they refer to sources of water and they occur in areas not altogether outside the most remote reach of Thura-Yura people.

[7] As pointed out by R. Amery (pers.com.) other factors were at work too in spreading names for homesteads far afield. H. M. Cooper's work of 1949 *Australian Aboriginal Words and their Meanings* and later the even more popular work of A. H. and A. W. Reed *Aboriginal words in Australia*, and A. W. Reed *Aboriginal Place Names* played a part in this: 'people looked up these books and liked the sound and meaning of the words and didn't worry at all where they came from. Indeed publications like Cooper's make no indication whatsoever where the words originated from. 'Willowie' appears in the 1957 edition of Cooper and perhaps in earlier editions.' (Amery, pers.com.)

Kadnyawi

There are a few such Thura-Yura type place-names ending in *-awi* in areas surprisingly far from Thura-Yura country. The one best known to Aboriginal people – and geologists- is *Kadnyawi.* This is the Aboriginal name of two springs near Mt Dutton, south of Oodnadatta. There is a 'Big' and also a 'Little' Cadna-Owie Spring, but only the 'Little' one is marked on the modern map-sheets (27° 47', 135° 41' SG5315 SA). Arabana people also used the term for Mt Dutton itself, and it has also become the name for the special type of geological formation exemplified by Mt Dutton. There is no mystery about what the name *Kadnyawi* meant to the most senior Arabana people: it meant 'Rock Water', but its origin is perplexing. One thing is quite certain, it is not Arabana, though the location is in the heart of northern Arabana country. The Arabana word for 'rock, rocky hill' is *kadnha* and this is in fact the pronunciation that would be equivalent to the European spelling Cadna, but Aboriginal people have never been heard by us to pronounce the place-name that way, they always say *Kadnyawi.* Further south in Kuyani and Adnyamathanha country the word for 'rock' is *kadnya* and *adnya* respectively. The name can thus be analysed as: *kadnya* = rock, hill, (c.f. Kuyani, Parnkalla, Nukunu *kadnya.*) plus *awi* = water, c.f. Kuyani *kawi,* Adnyamathanha *awi,* (the Arabana word for 'water' is *kutha).*

The meaning is therefore 'Rock Water', i.e. a rocky hill with springs, which is most descriptive of Mt Dutton. There is an identically formed name, Canowie, in Ngadyuri country (see above).

Mick McLean, the last person who could sing the songs for Mt Dutton, was puzzled by the name, as were other older people recorded in the sixties: 'I don't know why that place has Adnyamathanha's name!' *Kadnyawi* is important in mythology, it is a centre for the myth of the Pounding Stone and it plays a part in the myth of *Karlantyi,* the Bicycle Lizard. Whether either of these myths had links to the south, now long forgotten, we do not know, and so the origin of this name remains a mystery. Younger Arabana people have sometimes re-analysed the name as *Kadni-awi,* 'Lizard Water'.

Gnarrowie Well

This is the northernmost South Australian name ending in '-owie': it is a waterhole and soakage well just 3 kilometres south of the Queensland border on a small far western channel of the 'Georgina', i.e. Eyre Creek. 26 02 138 51 SG5409 6645. It is on the eastern edge of the Simpson Desert, in the country of Karangura people, who became extinct at the beginning of this century (Hercus 1991). Wangkangurru people called the site *Ngurrawani-(nha)*[8]*:* (Mick McLean on Hercus Tape 66, 1966). It was important both mythologically and historically, being effectively 'the last water'. It figured in the long myth of The Two Boys and was the centre of an area known as *Kawuka,* a ritual centre for the increase of birds of all kinds. It seems likely that the name Gnarrowie is not connected with the word *-awi* 'water', but was simply a corruption of the original name *Ngurrawani-(nha).*

Napeowie Waterhole

This waterhole is on a northern channel in the floodplain of the Cooper, in Yawarawarrka country at 27° 44', 140° 30', about 25 km west of Innamincka. No information is available on this place, the name is not listed by Reuther. The first part of the name may represent *ngapa* which means 'water' in Yawarawarrka and neighbouring languages. The second part of the name looks exactly like the Adnyamathanha word for 'water', but it is possible that here too we have a corruption of an unknown older Yawarawarrka name. Many important myths and song-lines are known to have travelled along the Cooper. The Napeowie waterhole is close to the important Kadripariwilpa waterhole, but it is not known as being a ritual centre that would have attracted visitors from afar. The origin of the name is therefore unknown.

Strzelecki Waterholes

There are two waterholes along the Strzelecki Creek in Yandruwantha country near Merty Merty and further south which could possibly have names in ending in Thura-Yura *-awi:*

Cadrapowie Waterhole 28° 33', 140° 17' SH5402.

Narcoonowie Waterhole 28° 44', 140° 12' SH5402.

A bore which appears to have an identical name is Nargonowie Bore 28° 28', 140° 49' SH5402. These places are in the middle of Yandruwantha country and Cadrapowie is at least partly a Yandruwantha type place-name, seeing that it

[8] Wangkangurru place names optionally take the proper name marking suffix *-nha,* cf below, Conclusion (2).

contains the characteristic sound-sequence *dr* found in the Diyari language group. There are a number of Yandruwantha-Yawarawarrka place-names which begin with *kadri* 'creek'. Too little is known about Yandruwantha sites for any conclusion to be possible. The influence of Thura-Yura cannot be ruled out, since the waterholes along the Strzelecki Creek are known to have been on the ochre route to the great mine at Parachilna in the Flinders Ranges, near the border of Kuyani, Parnkalla and Adnyamathanha country.

The name of the Caroowinna waterhole on the Strzelecki close to an important site near Chidlee is probably not linked at all with names in *-awi*. Reuther (VII 604 & 616) quotes two Yandruwantha place-names 'Karuwini', of which this is probably one, and the other is probably Carraweena, also on Strzelecki Creek.

Marnpi-awi Murnpeowie 'Bronzewing Pigeon Water'

This is the name of the large station situated by a waterhole in the Tooncatchyin Creek. It is a little to the north of Adnyamathanha country, in what was Diyari country according to Tindale, where the word for 'water' was *ngapa*. The name of the waterhole seems to have been originally simply *Marnpi* 'Bronzewing Pigeon', and Aboriginal people who have worked there still refer to the station by this name. 'Manpi' is also the name given by Reuther (VII: 1042), who associated the place with the sighting of a flock of pigeons by the Ancestors 'Kalkuwulana', 'the Two who belong to the Reed matrilineal descent line' (cf Reuther I: 1278):

> The two muramuras Kalkuwulana ('two reeds'), together with their father, Kalukupana, are listed as a constellation. These three once caught some fish with a dundru [= net] (c.f. dander and the story of Kalukupana). They saw a flock of pigeons there.

The station was originally called 'Blanchewater', and the main homestead was by the Blanchewater Creek. The name Murnpeowie does however appear on the pastoral map in use before 1888, for the name of the waterhole, as 'Murnpeowie Water'. Despite this early date it is still likely that Adnyamathanha stockmen introduced the name long ago. Over recent years, on account of the name, people have associated it with the Adnyamathanha-Ngadyuri Bronzewing Pigeon story, and the story is now sometimes said to start at Murnpeowie. We have thus an instance of an Adnyamathanha name being introduced into another country, and the myth following the name, whereas in the case of *Kadnyawi* 'Mt Dutton' the name probably followed the myth.

Murnpeowie is not far removed from other Adnyamathanha type names; for example, Aganowie dam is only some 20 km to the south. This may well also represent an introduced name, and a kind of 'overflow' from nearby Adnyamathanha country. How easily a name can be introduced is shown by evidence from John McEntee of Erudina Station, who has studied the Adnyamathanha language for many years, particularly from the late John McKenzie. Regarding the name Wundowie John McEntee writes (pers.com.):

> John McKenzie once told me that whoever was putting the bore down and struck good water at that place, asked John, or one of his family who happened to be working in the area at the time, 'What would you say for 'good water' in the Aboriginal way?' The answer came back as *'warndu-awi'*, i.e. *warnd'awi*, hence Wundowie.

Murloocoppie *Marlu-kapi* 'Kangaroo-water'

This is the name of some rockholes on the Stuart Range to the east of the railway line and off the Highway from Pootnoura Siding. It is also the name of a rockhole and of a bore, both to the west of the line and highway. The site of the western rockhole and the site of the bore were first called *Marlu-kapi* on the 1910 pastoral map, which also named a 'Murloocoppie Pastoral Co'. The eastern rockholes however have only been named so recently; they do not have this name on older maps, nor did they have it traditionally. This is a Western Desert (Kukata, Yankunytjatjara) name of relatively modern origin, as the area was once Arabana country, and obviously the sites covered by the name have been expanded much further very recently indeed (only in the post-1987 Murloocoppie mapsheet SH53–2) by the inclusion of the eastern rockholes. Pootnoura *Pudnura* is an original Arabana name, with the typical pre-stopped consonant *dn:* it was part of the country of the *Midlaliri,* the no longer extant western branch of the Arabana people. The name 'Murloocoppie' is likely to have been brought into the area by Kukata people with connections to the south. It is probably similar in date and origin to 'Coober Pedy', some distance to the south; this contains the word *kupa* 'white man', based on Parnkalla and Narangga 'kupa', 'ghost', 'white' (see Coopowie in Narangga country). The word *marlu* 'kangaroo' is Kukata-Yankunytjatjara, but the compound 'Murloocoppie' represents the Thura-Yura type of place-name with the word for 'water' coming at the end.

The place name 'Mintabie', associated with an opal field near Marla Bore, belongs to an area that is traditionally Western Desert country. This name also appears to be brought in by Kukata people with links to the south, and is identical to the name of the site, mentioned above, on the eastern side of Wirangu country near Lake Hart. Kukata, like other Western Desert languages, originally did not have place-names ending in the word for 'water', but Kukata people to some extent adopted this system of naming. It seems that place-names of the *-abi* type were transported by Kukata people to an area far away from Thura-Yura country in relatively recent times.

One other interesting example, due to Kukata influence, is 'Burntiltapy' near Ingomar[9], south of Coober Pedy and on the edge of traditional Kukata country. This is a Thura-Yura-type name ending in *-(a)bi* 'water', but the first part of the name contains the Arabana word *pantilta* 'fighting with one another'.

-awi in Far Western NSW

Euriowie is a most important engraving site some sixty kilometres north-north-east of Broken Hill. George Dutton, of Bandyigali descent, was the greatest authority for this area, and was acknowledged as such by Tindale (1939). George Dutton told Luise Hercus in 1968 that the Seven Sisters camped all along this creek and were constantly 'dipping' for water, i.e. they scooped up water with their hands and thereby deepened the creek. He thus confirmed information given to Elkin (1949: 139):

> A very trustworthy man of mixed blood, aged about fifty-five, whom I met at Nappamerrie belonged to the Wilyakali tribe..... He said that Euriowie was in the country of the Tinyano[10] tribe and that there were many markings in a rocky place along the creek near Euriowie. The engravings which represented tracks of men, babies and animals and also outlines of animals were made by chipping with a narrow hand chisel. He added that the old natives had told him that the Seven Sisters had made the petroglyphs with chisels before going up to the sky to live.

There can be no question as to the importance of this site (see also McCarthy 1970: 18). McEntee (1991) has shown how people travelled for ceremonies from the Flinders Ranges to Wilyakali country, to Poolamacca, north of Broken Hill. Euriowie is only some fifteen kilometres from there. It is therefore highly likely that Adnyamathanha people took part in ceremonies at this site also, and may have given their own name to this site. The word *yuri* means 'ear' in both Adnyamathanha and all the Paakantyi, Darling River languages, including Wilyakali, but the suffixing of *-awi* is of distinctly Thura-Yura origin.

There are two other names in Paakantyi country that could possibly represent borrowings from Thura-Yura, but nothing is known about them. One is Lake Narowie some 70 kilometres east of Broken Hill, the other is much further south, Tarawi, north of Lake Victoria, recently made into a nature reserve.[11]

Absence of placenames ending in *-awi*: Kuyani

In Kuyani country, and Arabana-Wangkangurru country, as well as in the area where Diyari and closely related languages were spoken, place-names do not end with the word for 'water': place-names containing the word for 'water' are formed quite differently.

The prevailing order in descriptive phrases in Australian languages is:

noun + adjective.

Thus one commonly says the equivalent of 'child good' and 'ground hard'. This is reflected in descriptive place-names: thus there are numerous places in the Lake Eyre Basin that mean 'bad water' or 'stinking water', with the word for 'water' coming first . Examples are:

Ngapa-thungka	'Water stinking', the Appatoonganie waterhole, south of Mulka near the Birdsville Track (Diyari).
Ngaka-thungka	'Water stinking', Nockatunga in South West Queensland (Wangkumara).
Ngapa-manha	'Water bad', the Appamana waterhole South-east of Pandie Pandie off the Birdsville Track (Yawarawarrka).

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[9] Ingomar is an Arabana name: *Inka-mangu* 'Yam forehead', the bald knob of root material left in the ground when a yam has been freshly cut.

[10] This is a clan name referring to the people of the Tinyano Range. 'Tinyano' was the old name of the Range to the east of the Barrier Range: the north-easternmost section of it is the Byjerkerno Ridge, running north-north-west from Euriowie (c/f also Le May, MS).

[11] Information from Peter Thompson of Wilcannia.

Ngapa-kaldri 'Water bitter', Lake Ngapakaldi in the Thirrari Desert (Thirrari).

The meaning of these place-names is exactly the same as 'Bookabie' in Wirangu country, listed above. It is however quite different in formation from 'Bookabie', which is of the 'Finch-water' type, where the final part of the compound singles out some attribute of the place, and where *-awi/abi* in fact fulfils the function of a post-positional classifier.

The Arabana-Wangkangurru word for water, *kutha*, is a relatively recent borrowing from the Arandic languages to the north which have *kwatye* 'water' (Hercus 1987: 73–80). This word is therefore not reflected in place-names with one exception, which is probably of recent origin:

Kutha-Parkulu 'Waters-two', a double spring just north of the Neales, west of Algebuckina.

The original word for 'water' was *ngapa*, as in the Diyaric languages, hence we find:

Ngapa Murilya 'Water dried out', Umbum waterhole (Arabana); this explanation appears already in Reuther (VII 1454).

Ngapa-kalti 'Water bitter' is the name of a waterhole of uncertain location on the Kallakoopah (Wangkangurru).

Ngapampara the lower Neales.

There are over 40 place-names beginning with *ngapa* 'water' listed for the Lake Eyre Basin by Reuther (volume VII), written at the turn of the century, but published only in 1981. There do not appear to be any names that end with the word for 'water'.

The two types of name-formation with the word for 'water' being the first or second member of a compound name are however not absolutely exclusive of one another, and there are in fact just a few Adnyamathanha names beginning with *awi* 'water'. Owieandana north of Mt Serle is the only one that appears on most maps. The name represents *awi-antha-nha* 'Water-Algae'.

Kuyani fits into this pattern of the Lake Eyre languages. The Kuyani word for 'water' is *kawi*. Kuyani country immediately adjoins Adnyamathanha on the western side. Although there are numerous springs and waterholes in Kuyani country, there do not appear to be any with names that end in *-(k)awi*, except in a small area not far from Parnkalla and Adnyamathanha country where we find:

Busheowie Creek and Well *'Puthi-awi'*, 'Down-feather Water'; on the north-eastern side of Lake Torrens. It is noteworthy that the final -i of 'puthi' is not elided here.

Old Winnowie *'Wina-awi'*, 'Chalk-water'; just south of the Ediacara Fossil Reserve.

Over the large area of the rest of Kuyani country there are no *-awi* names shown on maps, and we have not found any despite extensive work on Kuyani sites.[12] Names follow the 'Finches' type, not 'Finch-water'. Thus some springs opposite Hermit Hill are called *Murla-Murlapara-nha* 'A lot of crested pigeons', the Wangianna Springs are *Wanggiya-nha* 'Coolamon', and a small spring near Curdimurka is called *Thitari*, 'Baby' because in the myth of *Kudnangampa* a birth camp was there. The Kuyani word *kawi* 'water' does however appear at the beginning of a place-name: *Kawilanha* was the original form of the name Callanna, west of Marree. Alice Oldfield, the last fluent speaker of Kuyani, was born there in about 1885. The absence of names ending in *-awi* is all the more striking because of the fact that the Kuyani language is very closely related to Adnyamathanha: the two forms of speech can in fact be termed dialects of one language. In the formation of these place-names Kuyani people followed the practice of their northern neighbours throughout the Lake Eyre Basin and beyond, while Adnyamathanha followed the special Thura-Yura system. There are further traditional reasons behind this. Kuyani mythology and therefore Kuyani country was definitely northward-looking. All the main myths through Kuyani country travel along one axis, and only those marked * (below) go on from or to Parnkalla or Nukunu country, so more southerly

[12] There is one exception, Willowie Bore, shown only on the 1:100 000 map sheet Irrapatana (Billa Kalina) as being about four kilometres south-west of Welcome Spring. This could be the exception that proves the rule, but it could also be an import by Europeans, as there is a site with an identical name in Nukunu country, and one even in north-eastern NSW (see above under 'far-flung places' and also footnote 10). Aboriginal people never mentioned it to us as a site, though they gave names for the other spring/bore sites in the area.

Thura Yura people were not involved:
a. from north to south:
The Two Snakes *Yurkunangku* and *Kurkari*, the Two Emu Men, the Dogs*
b. from north to south and back again:
The Two Men*, The Grinding Stone Men, Old Man *Thudnungkurla*, The *Urumbula**,
c. from south to north
The Kangaroo, Old Man *Thunpila* carrying the dead body.

There are no major stories and songs that go in an east-west direction, except for part of the Seven Sisters myth. The fact that the main stories and song-lines were along this northern axis probably had a major influence on the naming of sites, and the principles of naming altogether.

Absence of placenames ending in *-awi*: Kaurna

Just as Kuyani was almost but not quite mutually comprehensible with Adnyamathanha, Kaurna was very close to Narangga. The situation appears to have been exactly parallel. Ibaritja, also known as Ivaritji, was the last fluent Kaurna speaker. Louisa Eggington, the Narangga speaker, told Tindale (1936: 55–6):

> that she had known Ibaritja and recognised that the dialects had much in common; nevertheless, she thought that Ibaritja 'was hard to understand'.

While, as shown above, Narangga had many place-names ending in *-awi,* there is no sure attestation of any such names in Kaurna country.[13] According to the maps, names in *-awi* peter out with the Condowie Springs north-east of Snowtown, and the Booborowie Creek north-west of Burra. The Kaurna people of the plains to the south and south-east of there simply do not seem to have used names ending with *-awi.* There is no dramatic difference between the Condowie Plain and plains further south, yet Kaurna people do not appear to have taken on the habit of forming these particular place-names. The system of using a descriptive or classificatory final is however not entirely absent: there are a number of rivers and creeks in the Adelaide Plains that are formed with the word 'parri', 'creek' as second member. Such names are not absent elsewhere in the area of the Thura-Yura languages, the best known being Wirrabara *Wira-paRi*, 'Gum Tree Creek' in Nukunu country.[14] They are however very prominent in Kaurna. Examples are (courtesy of Jane Simpson, pers.com.):

'Karrawirraparri'	'the River Torrens', (Teichelmann & Schürmann 1840).
'Moorta perringga'	'Upper vale of the Hindmarsh', (Wyatt 1879).
'Warriparri'	'the Sturt River', (Teichelmann & Schürmann 1840).

The most distinctive feature of Kaurna place-names is the use of the locative markers
'-ngga' (with disyllabic words) and '-illa' (with polysyllabic words) 'at such and such a place' as an integral part of a place-name, hence names like:
Onkaparinga *(Ngangki-parri-ngga)* Women-Creek LOC
and similarly Myponga, Willunga, Yankalilla, Kangarilla.

This system of having the locative as an integral part of a place-name is not used in the other Thura-Yura languages, however closely related, even Narangga. It is probable that it was a feature from further to the east, from the Encounter Bay language. Meyer (1840: 13) noted the use of locative case forms as place-names in this language:

> These words, Poltong, Kotungald, Wittingenggul, signify at the place which they designate.[15] What one would suppose from analogy to be the simple nominatives appear not to be used.

The clearest example of the correspondence between Kaurna and the Narrinyeri language of

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[13] There are a couple of -owie names of very recent origin in Kaurna country. R. Amery points out that the suburbs of Paralowie, according to Manning (1990: 161), was proclaimed on 27 Nov. 1980. It is stated there that the name is derived from two Aboriginal words para 'river' and 'owie', 'water'. It is highly likely that Europeans constructed the name. Amery also points out that the name of the 'Moorowie' walking track in Belair National Park was added along with other out-of-area Aboriginal names sometime between 1953 and 1968.

[14] Some names of creeks formed with -vari in the geographical index in Tunbridge 1988: 161 ff. may be due to the influence of the English pattern of adding 'creek' to differentiate the creek from a waterhole or other geographical feature of the same name. They were probably not always considered an integral part of the name. Only the simple names appear on maps, but this may be because there 'Creek' is being added anyway.

[15] Other well-known Narrinyeri place-name sending with the locative suffix are Coorong, Milang and Narrung.

Encounter Bay comes from Jane Simpson (pers. com.), and concerns the name of Encounter Bay itself:

> 'Encounter Bay' is called 'Ramung' by the Narrinyeri, and 'Wirramulla' (a variant of the name) by the Kaurna. They are two forms of the same name: '-ng' and '-illa' being the respective locative suffixes in the two languages, and 'R' being impossible word-initially in Kaurna.

Conclusion

The distribution of place-names formed with *-awi* presents a complex web of linguistic diffusion. The situation in summary is as follows:

1. Place-names ending in *-awi* or *-abi* are found throughout the area of the Thura-Yura languages including Wirangu, except for Kuyani in the north-west and Kaurna in the east.
2. The optional proper noun suffix *-nha* is characteristic of languages further north and in Thura-Yura it is found only in Kuyani and Adnyamathanha.
3. Kaurna forms a number of place-names ending with 'parri', 'creek' and among the Thura-Yura languages only Kaurna has the frequent use of the locative in place-names.
4. There are place-names in *-awi, -abi* beyond the limits of the Thura-Yura languages and some of these can be explained by traditional and ritual links.

It is possible that this distribution could have come about in the following way:

The process of using *-awi* as a descriptive or classifying term at the end of place-names as in *Idhi-awi* 'Finch-water' probably began long ago in Adnyamathanha and Ngadyuri country. It spread from there to Narangga, Nukunu, Parnkalla and Wirangu country. Kuyani people, who kept the northern way of simply saying 'Finches' instead of 'Finch-water', did not adopt it. Kaurna people did adopt the general principle of using a descriptive term at the end, as is shown by the names ending in 'parri'. Here they also developed their own way of naming by following the traditions of the neighbouring Encounter Bay language, using a location marking suffix '-ngga' and '-illa' at the end.

An alternative possibility is that all the Thura-Yura languages initially shared the 'Finch-water' type of place-names relating to water, and that Kuyani and Kaurna lost this method under the influence of neighbouring cultures. Whichever explanation one adopts, the situation with place-names shows that linguistic diffusion can overcome the strongest genetic links.

There are three main diffusionary processes at work:

1. Adnyamathanha and Kuyani both succumbed to influences from the north, adopting the optional *-nha* suffix which belongs to the Karnic languages (and is found as *-nya* in the Western Desert as well).
2. Kuyani either remained outside the sphere of diffusion of the *-awi/-abi* placenames, or lost them, under the influence of Arabana and other northern languages.
3. Kaurna either remained outside the sphere of diffusion of the *-awi/-abi* placenames, or lost them, under the influence of eastern neighbouring languages of the Yaraldi type.

Forms of speech that could be called dialects of one language and are almost mutually comprehensible, such as Narangga and Kaurna on the one hand, and Kuyani and Adnyamathanha on the other, thus came to differ from each other with regard to this salient marker of language-land affiliation. This shows up the well-known fact that Aboriginal languages are not predictable, one can never be categorical in making assumptions from one language to the next, however closely related. Cultural influences and the constant movement and interaction of people led to this complex diversity, which is clearly reflected in place-names. Each language is special and important and adds to the understanding of the whole diversity of the peopling of Australia.

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The present study would not have been possible without the help of the many Aboriginal people who over the years have spoken to us about place-names, particularly the late Mick McLean and the late Alice Oldfield, and Doreen and Gladys Miller of Bookabie. We are deeply indebted to John McEntee, Tom Gara, and Jane Simpson for their considerable contributions to this paper, and we are grateful to David Nash and Rob Amery for their comments.

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THE A. P. H. FREUND COLLECTION OF NEW GUINEA ARTEFACTS : AN HISTORICAL PERSPECTIVE

PHILIP FITZPATRICK

Summary

A. P. H. Freund was one of a number of missionaries from Papua New Guinea who donated collections of artefacts and photographs to the South Australian Museum. Freund's main collections came from the Wabag Valley and the Menyamya area of the New Guinea Highlands between 1948 and 1953. This paper describes the historical context in which the collection was made and its relationship to similar collections held by the South Australian Museum and other museums in Australia and overseas.

THE A. P. H. FREUND COLLECTION OF NEW GUINEA ARTEFACTS: AN HISTORICAL PERSPECTIVE

PHILIP FITZPATRICK

FITZPATRICK, P. 1999. The A. P. H. Freund Collection of New Guinea Artefacts held by the South Australian Museum. *Records of the South Australian Museum* **31**(2): 181–214.

A. P. H. Freund was one of a number of missionaries from Papua New Guinea who donated collections of artefacts and photographs to the South Australian Museum. Freund's main collections came from the Wabag Valley and the Menyamya area of the New Guinea Highlands between 1948 and 1953. This paper describes the historical context in which the collection was made and its relationship to similar collections held by the South Australian Museum and other museums in Australia and overseas.

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Introduction

The South Australian Museum has a number of significant Papua New Guinea collections made in the period immediately following the Second World War. During this period Norman B. Tindale, the Museum's Senior Ethnologist, enjoyed the strong support of the Museum Director, Herbert Hale, and was able to ensure that the collections coming into the Museum largely reflected his own research interests. It is useful, therefore, to understand Tindale's interest in Papua New Guinea before embarking on any detailed discussion of the Freund collection.

Tindale had briefly visited New Guinea in 1907 when the ship on which he was travelling with his parents to Japan called at Madang. In 1943 he had the opportunity to revisit New Guinea under very different circumstances. He had joined the RAAF in 1942 and, because of his background in Japan and his command of the language, had been assigned to the Pentagon to assist in the breaking of codes and the monitoring of Japanese military production. For this purpose a laboratory had been established in Brisbane to analyse debris from crashed Japanese aircraft (Jones 1994:162).

A number of aircraft had been shot down on the approach to the airstrip at Tsili Tsili on the Lower Watut west of Lae in August 1943, and were of interest to Tindale because they appeared to be new models. One was a 'Lily Mark 2', a new aircraft altogether. Anxious to examine it closely, Tindale left the RAAF base at Ardenfield at 4 a.m. on 22 Sunday August en route to Wards Strip near Port Moresby, arriving in the early afternoon. He flew on to Tsili Tsili the next day. Four crashed aircraft had been located, including one which had landed on a church in the engineer's camp killing the chaplain.

Tsili Tsili village had been deserted by its occupants but Tindale walked to a place called Pesen to inspect one plane and came into contact with the local people. He saw a number of interesting clay pots there and took notes. He also walked to another crashed plane near Morum village, just north of Tsili Tsili, and took photographs of the village and a 'red-skinned native boy called Fiugo who is a native of Tuyantuyu'. In the evening Tindale attended a sing-sing in another nearby village (Tindale 1943: 2).

Included in the journal which Tindale wrote at the time are photographs of Fiugo and Pesen village and a card with a reference to Beatrice Blackwood's 1939 article 'Life of the Upper Watut, New Guinea'. A reprint of this article is held in the South Australian Museum Library – presumably acquired by Tindale.

Tindale maintained his interest in New Guinea when he resumed his position as the Museum's ethnologist after the war. During 1948–49 he reinstalled and renovated the Museum's Pacific Islands Gallery, which had been removed to storage in a disused railway tunnel following the Japanese attack on Pearl Harbour in December 1941. Tindale had begun compiling a journal of notes and clippings related to the Pacific region as

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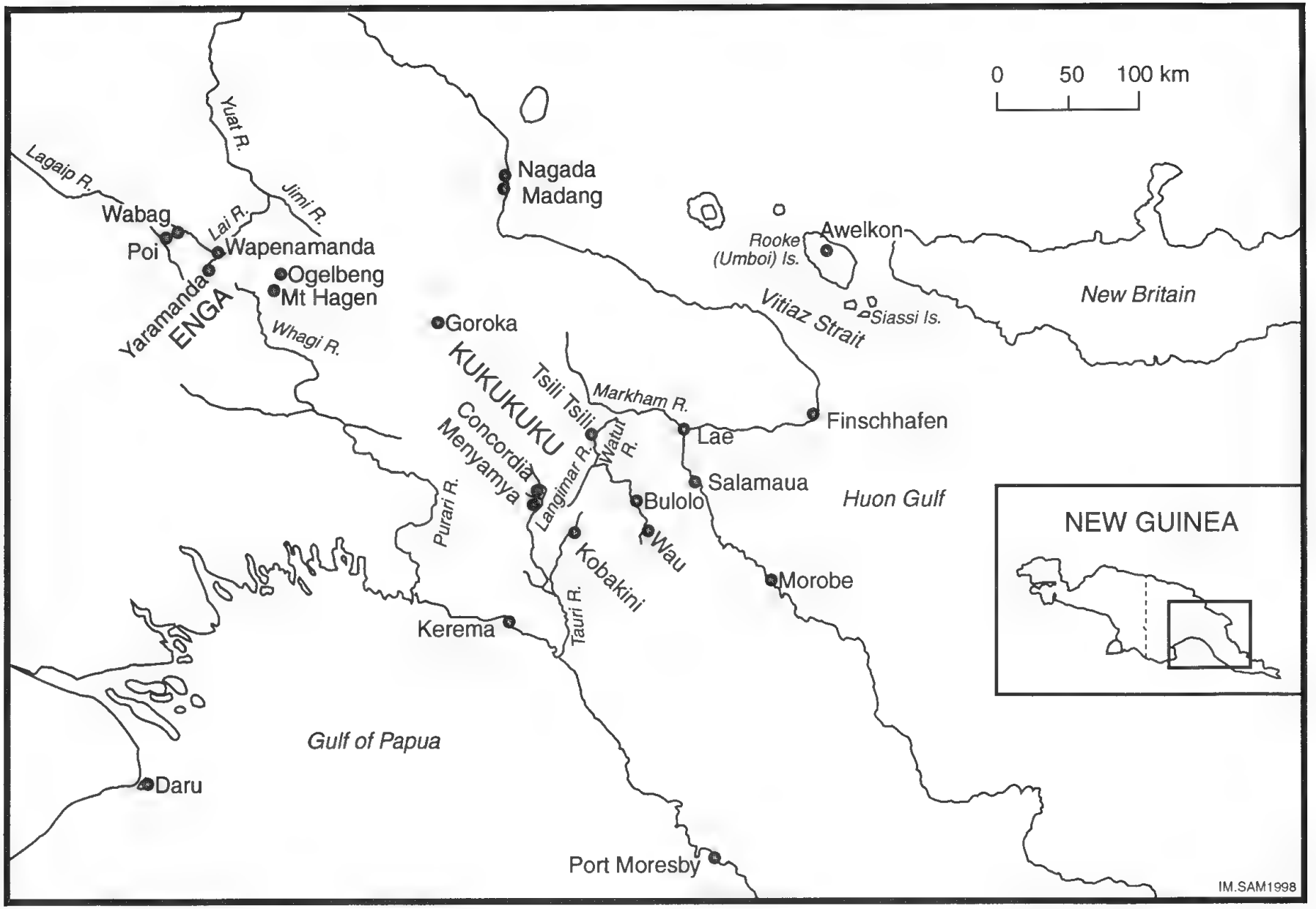
Pastor Freund died in Adelaide, 3 October 1998, aged 91 years.



Map 1. Areas in New Guinea where Freund worked.

early as 1934 when the spectacular discoveries of hitherto unknown large populations in the Central Highlands of New Guinea occurred (Tindale 1964). He was acutely interested in the further explorations of the Highlands after the war and he was anxious to supplement the Museum's older collections with new material from there. To this end he corresponded with the Australian Administration in New Guinea and set up a number of contacts with both government and private individuals through whom he could organise the collection of artefacts.

South Australia has a peculiar association with Papua New Guinea. The ranks of missionaries, traders and government officers who have lived in the region all seem to have been swelled by South Australians. The consortium of business men who set up Guinea Gold N.L. to first exploit gold dredging at Wau-Bulolo and then developed the famous Guinea Airways came from Adelaide (Idriess 1933: 142, 209). Many of these people donated or sold material to the Museum as they travelled back and forth. Tindale recognised and tapped into this traditional Museum resource and cultivated enough interest to ensure a steady supply of incoming ethnographic material from the newly opened up areas in New Guinea.

Of the 800 or so collectors who donated or sold Pacific material to the South Australian Museum, only about 10% assembled collections of significant size. Missionaries are heavily represented, particularly with respect to the Papua New Guinea collections, and specifically Lutheran missionaries, or people of German descent linked to the Barossa Valley (Jones 1993: 24). The Lutherans penetrated the New Guinea Highlands as early as 1929 and pioneered missions further and further west, almost on the heels of the first European explorers. One of the most significant donations to the Museum came from the Lutheran Pastor A. P. H. Freund, who pioneered missions at Yaramanda in the Enga Province and Menyamya in the Morobe Province between 1948 and 1953.

Freund's Early Background

August Paul Harold Freund was born near Eudunda on 6 July 1907. His parents were Johann and Anna Christiane (nee Fiegert). Johann had taken up virgin land in the low rainfall area near Mount Mary, west of Morgan, in 1887. Johann and Anna had nine children and Harold, as he became known, was the second to last.

Harold worked on his father's farm until 1925, when he was seventeen and a half years old, then he enrolled at Concordia Lutheran College and Seminary in Unley. He met Dora Ey whilst teaching Sunday School at the Bethlehem Church in Flinders Street in 1928. He graduated on 8 December 1933 and married Dora on 6 April of the following year in the Zion Church in Gawler. His first posting as a Pastor was to Arno Bay on Eyre Peninsula, where he was responsible for fourteen Lutheran communities (Freund 1989: 38).

There were two Lutheran churches in Australia at this time and it wasn't until 30 October 1966, that they united. Freund belonged to the Evangelical Lutheran Church of Australia (ELCA). The other was the United Evangelical Lutheran Church of Australia (UELCA), which had been involved in supporting missionary work in New Guinea since 1886 when the missionary Johannes Flierl arrived there. After Freund became a Pastor the ELCA decided to realise a long standing ambition and also got involved in missionary work in New Guinea.

The Mission On Umboi

Freund was one of four ELCA missionaries called upon to go into a non-mission area on the upper Sepik River. They travelled to New Guinea on the 'Macdhui', arriving in Port Moresby on 27 December 1935. However, while Freund and his companions were attending the annual mission conference at Finschhafen, the Lutheran Mission Finschhafen offered to cede their interests in the Siassi Islands, off the western end of New Britain, to the ELCA and also sell them their mission station at Awelkon on Umboi (Rooke Island). The Lutheran Mission Finschhafen was heavily involved in opening up new fields in the Central Highlands and found that its resources were being stretched by maintaining the Siassi Mission. For the purposes of the Property Trust Ordinance, Freund's group named itself the Australian Lutheran Mission (ALM) and he and Dora settled at Awelkon on Umboi at the end of 1936. The ALM saw the Siassi area as an excellent place to gain the necessary experience needed for later extending its activities to the mainland (Wagner & Reiner 1986: 255). Subsequent events were to delay those plans for some time.

On 6 May 1938 their first son, Martin, was born and on 16 June 1939 their second son, Roland, was born. In September of that year war broke out in Europe and in December 1941, the Japanese attacked Pearl Harbour.

The Allies had been mindful of Japanese aggression in South-East Asia and China for some years and were aware that the so-called Japanese fishing boats operating off northern Australia and New Guinea were in fact spying and preparing coastal mapping. German raiders had also begun sinking allied shipping in the Pacific and had landed the crew and passengers off several sunken ships at Emirau Island north-west of Rabaul.

Awelkon had a good view of Vitiaz Strait through which ships from South East Asia had to pass enroute to Port Moresby and Australia. In 1940 Eric Feldt recruited Freund as a Coastwatcher. Harold was the only clergyman recruited to the Coastwatchers and his decision, though it was made quickly, must have been extremely difficult. He did acknowledge, however, that the Teleradio 3B, which Feldt supplied, was very useful because Awelkon did not then have any contact with the outside world except by sea mail. When he returned from accompanying Dora and their sons to Adelaide, where she had gone for medical treatment, he also brought back 'a very fine but not too bulky' telescope (Freund 1989: 43).

The Second World War

After the attack on Pearl Harbour, Freund's involvement in the war rapidly escalated. Dora and the boys were evacuated to Australia on Christmas Day, 1941; they were among about 2 500 women and children evacuated in the space of about a week. Freund and several other Lutheran missionaries, all with German surnames, joined the New Guinea Volunteer Rifles at Lae on 18 February 1942. Harold was technically exempt but valuable because of his expertise with the Teleradio and he agreed to join up also. There was no medical examination, no training, no uniforms or identity tags and the oath was makeshift. He was given a rifle taken from the disbanded police force but 'misplaced' it soon afterwards.

In March of that year, Freund was involved in a dangerous sea-going rescue of the remnants of the Rabaul Garrison, organised by J. K. McCarthy who was then the Assistant District Officer (ADO) at Talasea. McCarthy collected the pitiful survivors from the garrison together using his New Guinea police and the group that Freund was in took four small boats over to collect them (Freund 1989: 54). This episode and Freund's role as a Coastwatcher would later hold him in good stead with the Administration, particularly when McCarthy became the Director of the Department of Native Affairs.

Freund was eventually discharged in Australia in July 1943 after 484 days of continuous active service, including a strenuous and dangerous walk through Japanese occupied country on the New Guinea north coast to Bena Bena in the Highlands near Goroka, whence he was flown out to Port Moresby.

In November 1946, Freund helped take a new mission boat, the Umboi-2, from Sydney to Umboi to resume mission work. The Japanese had occupied the mission and he spent 18 months getting Awelkon back in shape and the mission work going again.

In 1948 the Lutheran Church – Missouri Synod, USA, decided to launch into mission work in New Guinea. They had chosed the densely populated Wabag Valley as their field and approached the ALM for assistance during the establishment period. Freund and 'Pat' Kleinig were detailed to render that service.

European Exploration Of Enga Country

It is difficult to pinpoint when the Enga first came into contact with Europeans. William McGregor penetrated the Highlands from the Sepik as far as the lower Maramuni and returned via the Yuat in 1928. On this expedition he met people who would most certainly have been outlying Enga. The Fox brothers, Tom and Jack, explored an area west of Mount Hagen in early 1934 but their route is unclear (Taylor 1938–9).

The Enga's first major encounter with Europeans occurred in mid 1934. An expedition led by the tough and experienced prospector, Michael Leahy, had left Kuta, near Mount Hagen, on 11 June to explore the country west to the Dutch border. Leahy had been unsuccessfully seeking a major goldfield for many years and this area was the last largely unexplored region in New Guinea.

Leahy's initial dealings with previously uncontacted people in the Highlands had been relatively peaceful. A general belief that the prospectors were either the ghosts of departed ancestors or supernatural beings from another world had paved the way for largely unmolested travel. It was only when the truth became known that clashes occurred and these incidents were swiftly dealt with by Leahy and his men using their high-powered rifles.

The Enga were familiar with the concepts of

exploration and settlement well before they encountered the first European explorers. Their more spiritual accounts of evolution from 'sky people' are tempered by oral traditions of their own colonisation of the country by ancestors who came from the west and south-west (Bulmer in Lawrence & Meggitt 1965: 134). This pragmatic appreciation of such a concept made the Enga's reception of European explorers into their country quite different from that accorded by other Highland groups. While the Europeans were confidently expecting the Enga to be initially overawed by their presence and unlikely to be aggressive, the Enga were, in fact, simply confused and unsure about how to treat the newcomers. This confusion predisposed many of the Enga's first encounters with Europeans to unfortunate outcomes characterised by unprecedented violence.

On 25 June 1934 at a place called Doi, a few kilometres west of Wabag, a particularly bloody encounter took place which resulted in the deaths of fifteen Enga and the wounding of many more. While Leahy and his party were camped at Doi, the Enga there had engaged in a heated debate about what to do about them. One of the Enga leaders had argued that the strangers should be sent on their way as soon as possible. This man, named Pinketa, had quite unexpectedly urged the group of people below Leahy's camp to attack. Leahy had watched this event unfold and had shot Pinketa as soon as he began brandishing his spears. As soon as he fired, the rest of his men followed suit, firing indiscriminately into the crowd hitting both men and women. Further shootings occurred as the Leahy party progressed westwards and only ceased when Michael's brother, Dan, became ill with malaria and the decision was made to abandon the expedition and return to Mount Hagen.

Michael Leahy duly reported the incident at Doi to the Administration, which took no action against him. However, at a later lecture before the Royal Geographical Society in London, Leahy recounted the Doi incident and caused a furore which forced the Administration to further investigate the matter. This investigation endorsed the Administration's earlier finding but subjected Australia to much international criticism.

The miners Schmidt and Schultze attempted to follow Leahy's path soon after his return. They reached the Sepik via the Yuat but it is unclear where they actually went in between. Ludwig Schmidt became the first white man to be hanged in New Guinea following the reports of atrocities he committed against local people on this expedition.

When two Catholic missionaries were killed in the Chimbu area in late 1934 and early 1935, the Administration finally decided not to issue any further permits for miners or missionaries to enter uncontrolled areas and to severely restrict the activities of those already there. This effectively cut off the Enga from further incursions for several years (Connolly & Anderson 1987: 214).

Inevitably, this closure of the area west of Mount Hagen soon precipitated calls to open it up again. In both Papua and New Guinea various consortiums were looking for petroleum. The area around Wabag was of particular interest to these groups, for no other reason than the fact that they couldn't gain access to it. In 1938, partly as a response to this pressure, a large Administration patrol, under the leadership of Assistant District Officer Jim Taylor, with Patrol Officer John Black and Medical Officer, C. B. Walsh, set out to explore the area of Michael Leahy's aborted expedition west of Mount Hagen.

The Enga acccorded the Taylor patrol quite a different reception to that received by Michael Leahy, although Taylor persisted in believing that the Enga saw his party as the returning ghosts of their ancestors. It is interesting to speculate how much the Enga had learned about the Europeans in the intervening years. The Enga had trade contacts with the Medlpa, close to Mount Hagen, and must have picked up a lot of useful information by this means. When Taylor walked along the Lai Valley he noticed quite a number of steel axes which presumably had been traded in from the Mount Hagen people.

Taylor was initially wary of the Enga but gradually came to trust them.

> When the people got to know us they liked us, only when we are the unknown quantity are they suspicious and unfriendly (Taylor 1938–39: 42).

He was also impressed by their sophisticated gardens, wide, well drained and graded tracks and substantial bridges. On the Waga he noticed two young casuarina trees deliberately planted so that they could be used as bridge pylons when they matured. He camped at Doi (Tore) where he found the people

> bright and friendly and apparently bore no malice, realising, I imagine, that the trouble was their own making. They appeared quicker in the uptake than those down the valley and had more to say (Taylor 1938–39: 44).

Taylor was searching for a suitable site for a base camp and airstrip:

> On the 21st July we drew in to Wabag, on a high terrace with a good depth of black soil, above the right bank of the Ive (River) Lai, not far above its junction with the Ambum. The area was inhabited by two groups known as Kulliner and Man-gia.
>
> I explained to the people what we were going to do, through Leo, who was now our best interpreter. He made an eloquent speech which impressed the people, or so it appeared to me, for they listened in silence and at its conclusion struck the ground ecstatically with their stone axes and told us to carry on. I think they wanted to see the aeroplane.
>
> We began immediately preparing a landing ground on a stretch about 800 metres long by 40 metres wide. It was on a gentle incline but was covered in wild sugar-cane which meant a lot of cutting, grubbing and burning.
>
> . . . on the 8th August at 10.25 a 3-engine Ford, pilot T. O'Dea, landed on the ground. People flocked to the camp from every direction, there was much singing and dancing. O'Dea was a great success as he always is with inland people. From 1932 he has worked with us in all parts of the plateau, and being a singer of no mean order the people shriek with delight when he sings to them songs from Pagliacei, Cavalleria Rusticana and Tosca. They love to see a white man act as a human being (Taylor 1938–39: 75–78).

Despite the apparent friendliness of the Wabag people, an attack, in which a Police bugler was killed, occurred at Wabag two days after Taylor had left with the main party for the Sepik. The boy bugler was with a party sent out to buy pigs. He became separated and was brought down with a stone axe. During the rescue of the party, led by Sergeant Fokinau, two police and four carriers were wounded and about eleven Enga killed. Medical Officer, C. B. Walsh, radioed the Administrator and the District Officer from Morobe, Edward Taylor, flew in and succeeded in defusing the situation.

In September, while Taylor was still away on the Sepik, Patrol Officer Ian Downs went to Wabag and began a series of local exploratory patrols. Among other places, he visited the Tarua and Sau, tributaries of the Yuat, with Walsh. During a visit to the Lai Valley, Downs noted that the valley between Yaramanda and Link 'is out about with tribal disputes which have left a trail of desolation'.

Later, Patrol Officer Lloyd Pursehouse (who was with Freund during his time as a Coastwatcher and was later killed by the Japanese) replaced Downs and accompanied Walsh to explore the upper reaches of the Lagaip. On 17 April 1939, after Black had returned from an expedition to Telefomin, the New Guinea Administrator, Sir Walter Ramsay McNicoll, flew in to Wabag and stayed overnight. About three thousand Enga came in to Wabag to meet him.

Taylor and his party left Wabag on 7 June 1939, following an Enga trade route to Mount Hagen which Patrol Officer Murray Edwards had been shown. On 18 June they reached Mount Hagen and met Patrol Officer George Greathead at the head of a road he was building to the west.

A number of Patrol Officers using the route pioneered by Edwards made sporadic visits to Wabag after Taylor returned. In 1942 a permanent Patrol Post was set up there by ANGAU officers. Expatriate refugees walking inland from the northern coast to escape the Japanese often made for Wabag and then Mount Hagen.

By 1960 three other Patrol Posts had been established in neighboring valleys. In 1973 the Enga area became a district in its own right and is now one of the nineteen provinces of Papua New Guinea (Sinclair 1981: 160).

The Mission At Yaramanda

A Seventh Day Adventist pastor, L. A. Gilmore, visited Wabag in 1944 as a Paramedic with ANGAU following reports of an outbreak of Bacillary Dysentery amongst the Enga. The dysentery had been introduced into the area by soldiers passing through Wabag and was one of the first Engan introductions to the more subtle and unpleasant aspects of European intrusion into their country. Two Seventh Day Adventist pastors, Frank Maberly and Laurence Howell, flew into Wabag on 4 June 1947 to set up their first mission at Rakamanda (Kopamu 1994: 29). The first Catholic mission in the Enga area was set up at Pompabus, a few kilometers outside Wapenamanda, in February 1948 by Father Gerry Bus and Father William Ross of the Society of the Divine Word. They had flown into Wabag in October the previous year to make arrangements for the mission with Patrol Officer B. Macillwain (Kruczek 1995: 18).

In 1947 the westernmost Lutheran mission was at Ogelbeng near Mount Hagen in the Western Highlands District. Rivalry between the missions in New Guinea had always been fierce. The Lutherans, Catholics and Seventh Day Adventists were particularly competitive and, despite a number of inter-denominational meetings to discuss and resolve the problem, the poaching of

converts and districts was rife (Flierl 1937: 22). Since the Catholics and Seventh Day Adventists had already entered the Wabag Valley the Lutherans knew they had to move quickly to stake a claim in the area before the other missions expanded their influence too far.

The Lutheran party, comprising Freund, Reverend Felix Doering and lay worker Armin (Pat) Kleinig headed for the vacant mission area at the eastern end of the valley and for this reason they decided to go overland using the well worn track between Mount Hagen and Wabag. They left Ogelbeng on 23 August 1948 with 230 carriers and reached the Wabag Valley three days later. The local Laiapu Enga people had selected a site for the mission which did not appeal to Freund and his party and they carried on past it for a few kilometres until they came to a knoll on neutral ground at the boundaries of three different clans. The spot was near the abandoned police post at Pausa, overlooking the Lai River. After the Enga had agreed to the site, which was called Yaramanda, Freund and Felix Doering walked the 50 kilometres to Wabag to seek approval for the mission site from the Administration. Dora and their two sons arrived at Yaramanda in December (Freund 1985: 117).

At Yaramanda, Freund saw the complex travelling *Te'e* festivals where pigs and other valuables were paid out to cover debts. He also saw initiation ceremonies where young men received their first wigs. The richness of the Engan culture fascinated Freund and he took the opportunity to learn more about it. During this process he began to acquire a number of artefacts.

The Enga People

The Enga are now generally divided into clans, but in Freund's time the patrilineal tribe was still significant. The clans within the tribes divided into sub-clans and lineages and lived in hamlets. There are cultural differences between the Western and Eastern Enga. The Western Enga are divided into the Mae and Yandapu and the Eastern Enga into the Syaka (or Kyaka) and Laiapu. The latter group is centred around Yaramanda. The population density of these four groups exceeds 150 people per square kilometre. On the fringes of the groups the density is much lower, averaging less than forty people per square kilometre. In total there are approximately 250,000 Enga, making them the largest linguistic group in the whole of Papua New Guinea.

The vast majority of the Enga are bush-fallow cultivators, with sweet potato and, to a lesser extent, taro as staples. Pigs formed the basis of Enga wealth and were supplemented with shells, salt, stone axes, net bags, skirts and tree oil. The elaborate exchange and debt system (*Te'e*) involving these valuables was the element which provided social cohesion for the Enga. The same system, called *Moka*, was used further east around Mount Hagen by the Medlpa people (Kyakas & Wiessner 1992: 130).

Since the 1950s the Enga, as with other Highlanders, have been major subjects of anthropological study; see, for example, Brennan (1970), Brown (1978), Freund (1969), Sillitoe (1988) and Kyakas and Wiessner (1992). Enga culture, including its material culture, has been described in detail in almost every aspect. The literature is extensive and readily accessible to both the academic and lay reader. It is useful, however, to look briefly at the descriptions of the Enga provided by Jim Taylor when he first entered the area in 1938.

> Boys go naked to about 10 years and girls to 3 or 4 years when they wear a small net covering. When a girl reaches puberty she puts on a rush skirt which is called *kwerra*; the rushes are grown in small ponds very often made artificially for the purpose. When about 3 feet high and turning white the plants are taken out or cut and the rushes flattened and made into tapes. These are made into skirts which reach to just above the knee in front and hang almost to the ground resembling a horse's tail, at the back. The ends are trimmed, being made perfectly even and the skirt is open at the side to give the leg free movement. They are white in colour and not unattractive in appearance.
>
> As the boys grow up they wear several nets folded double over a belt of waist strings and reaching to the shins. A bunch of lily leaves (*Cordyline terminalis*) form the posterior covering of the men.
>
> Women wear their hair short and cover their heads with a net shawl edged with white beads of Job's Tears. A string bag is knotted on the crown of the head and carried on the back. Though this is for use it is also an article of apparel, and no woman would walk abroad without one.
>
> The men allow their hair to grow long and wear it in a mop, sometimes turbaned with tapa cloth. The hair is cut with bamboo knives and large wigs of two patterns are made, the mop and the cossack type. The small cowrie is the principal decoration, and necklaces are worn and the shells threaded from side to side and sometimes in rosettes. The women prefer however the white and grey beads known as 'Job's Tears' which they grow in the garden. Huge

> necklaces are wound hundreds of times around the neck and carried on the shoulders. Older men wear beards and are very proud of them. Combs are unknown and the hair is dressed with a single prong.
>
> The staple food is the sweet potato, and beans, cooking bananas, native spinach, taro, yam and sugarcane together with nuts, seasonings and other vegetable foods obtained from the forest, make up the diet. Pork is the principal meat food but this is augmented by opossum, field rats and eels . . . Dogs are not eaten and fowls are unknown. Ginger is used as a stimulant and tobacco is grown, but is smoked only by full adult men.
>
> Settlements are usually of two or three houses placed close together. A man's house where men of the family sleep and women's houses for the women and girls . . . The houses are well-built but are small affairs about 24 ft x 8 ft and 6 to 10 ft high, the rear end of the houses being about 4 ft higher than the front. Walls are 5 ft high and are made of pickets and pandanus leaf. The frame is of wood and the roof of coarse grass (kunai) where obtainable, and the stalks of reeds where it is not. Inside, the men's houses consist of one room devoid of luxury. Women's houses are divided into three, a living room at the front where meals are eaten; the men come to meals; stalls for pigs and a bedroom. The inmates sleep on mats on the ground and fires are kept burning in fire-places made of clay and stone all through the night. They are warm and dry and very suitable for the climate, but are mad. uncomfortable by smoke and the common flea (Taylor 1938–39: 141–2).

Taylor described the Enga religion in fairly simplistic terms: a goddess, Yemborne, and a god, Tai, descended from the sky and taught the Enga 'arts and crafts' and then ascended again and remain watching over them. Taylor also alludes to the worship of sacred stones, which are guarded closely. This is similar to a belief amongst the Hagen people called *Kur* (Taylor 1938–39: 143).

The Enga focus their religious beliefs both on the 'sky people' and on the spirits of their ancestors. Keeping both groups happy and placated is believed to be the source of harmony in the Engan world and a number of special feasts are held in their honour. The 'sky people' were created by Aitawe, represented by the sun, and dissociate themselves from earthly concerns except on a grand scale, such as in matters related to weather, earthquakes and land-slides. They have a loose connection with the ancestors and their existence and influence is celebrated in a range of colourful myths (Kyakas & Wiessner 1992: 136).

As noted above, pioneering the Lutheran mission work in the Wabag Valley was a joint enterprise between the ELCA and the Lutheran Church-Missouri Synod. However, when the Executive Secretary of the Board of Missions of the Lutheran Church – Missouri Synod, Dr. O. H. Schmidt, arrived at Wabag with the Synod's first missionaries, Willard Burce and Otto Hintze, he announced that the joint enterprise was not to continue. On this basis Kleinig returned to Siassi towards the end of 1948. Freund and his family stayed on helping Burce and Hintze until 22 June 1950 before going back to Siassi. Both Freund and Kleinig were destined for more pioneering work elsewhere, this time amongst the Kukukuku.

European Exploration Of Kukukuku Country

Whether deservedly or not the Kukukuku had the reputation as the most dangerous, aggressive and savage tribe in the whole of Papua New Guinea. The stocky little fighters raided as far south as the Papuan Gulf and in 1906 the Administrator of British New Guinea, Captain F.R. Barton, established an administrative outpost on the coast at Kerema principally to curb their depredations. When not raiding their neighbours the Kukukuku fought amongst themselves and when the first Europeans penetrated their boundaries they took them on too (Sinclair 1966: 7).

The famous 'Outside Man', Jack Hides, described the daring of the Kukukuku as 'colossal' (Hides 1936: 202). District Commissioner and planter, Ian Downs, whose adolescent Kukukuku interpreter had been presented to him one morning disembowelled and impaled in sections on the defensive stakes of his camp boundary, was less sanguine in his praise. He later described the chill he felt when he momentarily mistook the shaven heads of Hare Krishna in the streets of Sydney for Kukukuku (Downs 1986: 8).

In some instances the Kukukuku's reputation preceded them; a report in the 'Illustrated London News' in 1931 attributed the murder of pilot Trist at Zenag to the Kukukuku when it is well known Zenag is well out of their territory. I suspect this article was written by Ion Idriess and it is possible he confused Zenam, a base camp on the Isimb River in Kukukuku country, with Zenag. Trist had, in fact, crashed into a mountain and been killed. Local people led the search party to the crash site.

Captain Detzner, of the German Administration at Morobe, is thought to have been one of the first Europeans to penetrate Kukukuku country. He

entered the area south of Wau when he was in hiding following the Australian military annexation of German New Guinea in September 1914. Resident Magistrate W. R. Humphries patrolled the southern fringes of the area out of Kerema at about the same time and about 1928 a group of prospectors, including Soldwedel, Zacharov and one of Detzner's old soldiers, Helmuth Baum, are known to have reached an area south of the Upper Watut. By 1930, Australian Administration patrols led by such officers as E. Feldt, N. Penglase and A. Roberts, were regularly entering the area from the Otibanda Patrol Post on the Upper Watut (Hurrell 1951: 17).

In 1931, Helmuth Baum and eight of his Buang carriers were killed in the Kareeba-Indiwi area. In the same year Mick and Pat Leahy were attacked near the Langimar River and both were injured; Mick felt the effects of a club blow to his head for the rest of his life. In 1932 the prospectors Emile Clarius and Bill Naylor, with seven Buang carriers, were killed at Kobakini near the Kapau River. Naylor and Clarius were attacked as revenge for the men taken away to gaol and presumed dead after arrests were made following the murder of some Kukukuku women in inter-tribal fighting.

Patrol Officer Bridge found the bodies of the prospectors but failed to apprehend the murderers, as did a subsequent patrol. J. K. McCarthy, returning from a patrol in the area, made a third attempt and was attacked and wounded. He was ill-prepared for the arrests, carrying neither handcuffs or leg irons and, as it transpired, only captured one of the men involved in the murders of the prospectors. His unfortunate police were tied by ropes to the prisoners and caught the full brunt of the Kukukuku attack. Three innocent Kukukuku were killed during the arrests, two died in the attack and another two attacking the patrol were shot dead. Six police were injured, including Corporal Anis, who was shot through a lung with an arrow and later died. None of the carriers were fired upon by the Kukukuku (McCarthy 1933: 12). Subsequent published accounts of this incident portray the Kukukuku as bloodthirsty ambushers but McCarthy's original patrol report belies that version.

Following this patrol McCarthy made a glowing report of the gold prospects in the area and convinced the Administration to set up an airstrip there for the purpose of allowing prospectors access. He returned there in September 1933 with Cadet Patrol Officer John Black, a South Australian who later accompanied Taylor on the Hagen-Sepik Patrol in 1938–9, and Surveyor George Ballam to set up a base camp and build the airstrip.

McCarthy chose a river flat which he had seen on his earlier patrol at the junction of the Tauri (Kotai) and Yakwoi Rivers for the site of the airstrip. The nearest village to these flats was on a ridge to the west and was called Menyamya. McCarthy adopted this name for his base camp. The river flat was strategically placed between the warring Gainyama and Etobanga Kukukuku, and neither group permanently occupied it (McCarthy 1963: 120).

Patrol Officers John Costelloe and Murray Edwards (who had recruited Down's unfortunate interpreter) had both been driven away from the Menyamya area by the Kukukuku but had not sufffered casualties and McCarthy felt that once he had an airstrip built it would be possible to allow miners into the area. To the momentary amazement of the Kukukuku, Tommy O'Dea, the manager of Holden's Air Service at Salamaua, flew a De Havilland 50 biplane with a single 450 horse power Jupiter motor into Menyamya on 3 September 1933. The Kukukuku obviously took this event in their stride because one of the men Tommy O'Dea flew out to Salamaua to see the ocean led an attack on one of McCarthy's patrols two weeks later and was shot dead (Simpson 1962: 44).

Over the next few months prospectors entered the area by aeroplane and under the protection of McCarthy and the other Patrol Officers there they investigated most of the surrounding country (Black & Bridge 1934: 10). The Kukukuku were mystified by these incursions and occasionally attacked McCarthy's patrols. McCarthy's optimistic predictions about viable gold deposits in the area quickly proved fruitless however and the Administration told him to close down the base camp. New areas were being opened up to miners in the newly discovered valleys of the Central Highlands and the Administration had decided to concentrate its efforts elsewhere (McCarthy 1934: 3; Sinclair 1966: 8).

In 1936, the Lutheran missionaries Lechner, Reiner and Maurer explored the country south of the Wau and Bulolo goldfields. They reported significant populations and received approval from the Administration to enter the area but not to set up missions. At the same time, Patrol Officer A. T. Timperley, working out of Kerema, established a temporary patrol post on the Upper Tauri close to the Papuan border.

The Kukukuku continued to harass the sporadic patrols which entered their territory over the next seventeen years. Ian Downs was driven out of the Kobakini area where he was endeavouring to set up a base camp in 1937 and he was again attacked at Imisi on the Upper Banir by the Siminapa Kukukuku in 1947. Downs reported that the Kukukuku had their own unique humour,

> a theatrical pantomime of denials that they had ever attacked us followed by tearful demands for the return of their arrows (Downs 1986: 4).

By the 1950s the pace of development had markedly quickened in Papua New Guinea, particularly with the influx of planters into the Central Highlands. In 1949 the Chifley government had been defeated by Robert Menzies and the United Nations had approved the administrative union of Papua and New Guinea, with Port Moresby as the permanent capital. In 1950 a system of Native Local Government Councils was inaugurated and the Administration prepared itself for the first United Nations Visiting Mission (Downs 1980).

Buoyed along by these rapid changes and encouraged by the general post-war optimism, the Administration, under Colonel Murray, set the elimination of restricted areas in the Territory as a major goal (West 1968: 69). In 1950 the decision was made to reopen Menyamya. Assistant District Officer Doug Parrish and Cadet Patrol Officer Garry Keenan were assigned the task but at the last moment Doug Parrish broke his wrist and was replaced by Assistant District Officer Lloyd Hurrell. Hurrell was a dedicated and tough officer who had been shot in the legs during the war but had refused to discontinue patrolling.

Hurrell and Keenan left Slate Creek on 31 October accompanied by 157 carriers loaded down with over two tons of food and equipment, guarded by thirteen police and accompanied by an interpreter and medical orderly. The patrol reached Menyamya early on the morning of 9 November, 1950 and immediately began clearing the old airstrip. Soon De Havilland 84 biplanes from Lae began to arrive on a regular basis (Sinclair 1981: 75).

Two months later Hurrell felt confident enough about the situation at Menyamya to bring his wife Margaret and their two children Peter and Lesley to live there. Whether intended or not this was a turning point in the Administration's relationship with the Kukukuku. Suddenly the Kukukuku saw the strange white invaders in a new light; they were normal human beings, just like them, with wives and children! Young Lesley Hurrell, who had pure blond hair, was of particular fascination to the Kukukuku and they delighted in her presence (Sinclair 1966: 12).

The Mission At Menyamya

In early 1950, the ELCA Mission Board Secretary, who had heard reports of what appeared to be large populations in the area from commercial pilots, had flown over the Kukukuku country to confirm these reports. When Freund and Kleinig returned to Umboi they were invited to attend a Lutheran Convention at Busamang (on the coast between Lae and Salamaua) where it was decided that Freund should lead a mission into the Kukukuku country. On 24 November 1950, with Rev. Georg Horrolt and Rev. Fred Scherle, Freund flew to Menyamya to assess the situation and discuss the establishment of a mission with Assistant District Officer Hurrell.

Hurrell had been quick to recognise the proposed mission as another opportunity to consolidate the headway he was making with the Kukukuku. He was delighted when the Administration quickly approved the Lutheran application, noting that one of the missionaries, Pastor Freund, had seen military service during the war, a fact which he thought influenced the Administration's attitude to the proposal (Hurrell 1996).

Menyamya was classified as a Restricted Area, however, and it was necessary for the missionaries to also apply for permits to enter the area. Freund's sons were ready to begin their secondary schooling and since he was due for furlough Freund thought that the period spent waiting for the permits could be used to settle them in their Australian school. On this basis he travelled with his family to Australia by boat in early 1951. The permits were approved within six weeks, however, and Freund, for the first time, travelled by aeroplane back to New Guinea.

The Menyamya advance party consisted of Freund and Horrolt. Horrolt was an experienced missionary who had assisted in setting up the Lutheran Mission at Ega in the Chimbu in 1934. Accompanied by one church elder and two servants they arrived on 13 March 1951. Freund has said 'this date may eventually be regarded as the date of the beginning of our mission work in the Menyamya area' (pers. com.). Hurrell provided a hut for Freund and his party and even supplied meals. Freund and Horrolt identified five

acres for the mission and 120 acres for gardens and stock on a knoll across the river from the Administration station and arranged with Hurrell for its purchase.

Freund and Horrolt were soon joined by Scherle, Kleinig and school teacher Owen Altus. It took nine Dragon Rapide plane flights over a two week period to transport the personnel, stores and equipment for the mission station from Lae to Menyamya. Freund recorded in his diary the fact that the plane could only carry 1200 lbs [544 kg] per trip and the 55 minute flight each way cost 28 Pounds [$56].

The personnel included twenty evangelists from the Lutheran's coastal stations, three accompanying elders and two servants. The Lutherans worked on the principle of the 'self-propogating Native Church' by sending out Papua New Guinean evangelists. These evangelists were seen to be more readily admitted into new territory than European missionaries (Frerichs 1957: 16). Freund discussed this approach with Hurrell and they agreed that sending out evangelists amongst the Kukukuku at such an early stage would not be safe. Consequently over half of the evangelists were returned to the coast.

At first Hurrell placed a two mile limit out of Menyamya on the mission staff and a five mile limit on Freund, but this gradually increased as time went by. Hurrell (pers. com.) also enforced the rule under the Restricted Areas Ordinance that parties venturing outside the mission had to be armed and Freund concurred, although he wondered what the Administration would have done if he, as a missionary, had actually shot anyone, not to mention what the rest of the world might have thought.

Owen Altus was recruited for Menyamya because the Lutherans were convinced that education had to be a basic aspect of their mission work. Hurrell got on well with Altus and the two men are now related through a family marriage. Hurrell also thought Fred Scherle was a good influence at Menyamya and he developed a lasting friendship with him also. Georg Horrolt, on the other hand, did not settle into Menyamya as well and left.

The missionaries bought building materials from the Kukukuku with bush knives, axes and shells. The women brought in sweet potato and corn to sell and these were also bought. Freund weighed one woman's load at 38 kg, which she carried with a baby over 17 km. Another woman weighing 47.6 kg brought in a loaded *bilum* (string bag) weighing 52.2 kg from 4.8 km away. Initially the women kept their bark cloaks drawn around them and were always accompanied by a bodyguard. Later they relaxed and came to the station by themselves (Freund 1985: 146).

Freund brought the first cattle into Menyamya on 25 November 1952 and the first calves were born in October 1954. On 26 February 1955 Deaconess Merna Thamm arrived to work amongst the women. Reverend T. W. Lutze established Kwaiguma station, about fourteen kilometres east of Menyamya in 1951. Freund helped Reverend Russel Weier start the Kwaplalim station, about fourteen kilometres west of Menyamya, in September 1957. Ken Cramer established his medical centre at Womgaga, not far from Kwaiguma, in 1960. In 1962 a station was established near Eyokaga, about ten kilometres north of Menyaymya. This station was called Concordia, partly in honour of the Lutheran college in South Australia but principally because of the difficulty of rendering an accurate spelling of the local Kukukuku name for the site. A road was built from Menyamya to the station and the Freunds moved out there on 16 June, 1964.

Menyamya was a pleasant spot for the Freunds. It is located about 120 km west-south-west of Lae, with the airstrip at 1 128 metres and the surrounding hills up to 2 438 metres. The rainfall is consistent all year but varies between 1.1 and 2 metres per annum. The usual temperature range is from about 16 to 29 degrees, although in May the overnight temperature has been known to drop to 2 degrees. The warmth is tempered by a breeze blowing up the valley in some months and down in others. Fogs, which are a nuisance to pilots throughout New Guinea, are rare at Menyamya.

The Kukukuku People

The term 'Kukukuku' is not one familiar to the people it purports to describe. The general consensus is that the word is derived from the Motuan *kokokoko*, which is the word for cassowary, and describes the distinctive cassowary-bone belts worn by Kukukuku men after the birth of their first child. Other connotations are more derogatory. In a letter to Tindale dated 15 October 1951, Freund noted that the term caused offence to the Menyamya people. Pressed further, Freund reported that the Menyamya Kukukuku referred to themselves as *Ngwodiaga* but did not provide any further information. A more colourful, and predictable, version of the term comes from the Upper Watut

people who say that the first Patrol Officer, when asking them who they were, mistook what a man said when he replied '*kouka*', their word for man or boy (Burton 1996: 2). Simpson (1962: 19) reported that the Bulolo people referred to the Kukukuku as the *Babwaf* or *Babwa* but this is the name of a village on the Watut River (McCarthy 1933: 5).

Faced with this dilemma in terminology, a number of researchers, including Lloyd and Gajdusek, proposed the word *Anga*, which is almost universally used by the Kukukuku to describe the concept of 'home'. The word has caught on with some researchers but is, according to the Curator of the J.K. McCarthy Museum in Goroka, Ivan Mbaginta'o, who is himself Kukukuku, not in common usage amongst his people. Mbaginta'o, however, uses the term Anga in his own publications. Since this paper is principally concerned with the historical context of Freund's collection, rather than its anthropology significance, I have opted to maintain the older term.

Hurrell and Keenan estimated there were about 22 000 Kukukuku living within a radius of sixteen to twenty kilometres of Menyamya in 1951, with a strip of land about 20 kilometres wide all around designated 'no man's land' (Keenan 1952: 6; Freund 1985: 138). The northernmost part of their country is the point where the Langimar River joins the Watut, which eventually links with the Markham River and flows into the sea near Lae. Their southern boundary extends almost to the Gulf of Papua in the vicinity of the Lakekamu River. Mount Yule marks their eastern boundary and the Vailala River their western boundary. Their present population is in the vicinity of 70 000 – 75 000 (Hallpike 1978: 1; Hides 1936b: 8; McCarthy 1963: 90).

Much public interest was created in Australia and overseas in the Kukukuku following the publication of W. R. Humphries' 'Patrolling in Papua' in 1923 and especially after a series of books by Jack Hides, one of the so-called Papuan 'Outside Men'. A number of striking photographs of the Kukukuku taken by Patrol Officer G. F. W. Zimmer and published in the Papuan Report (1925–6) were also reproduced in a number of popular journals both in Australia and overseas in 1927 and were later used by Zimmer himself to illustrate an article in the *Pacific Islands Monthly* (Zimmer 1969: 85–93). The development of gold mining near Bulolo also focussed attention on the Kukukuku in the 1930s (Fisher 1936: 10). Unfortunately the primary fascination with the Kukukuku centered on the the myths that had evolved around their reputation as warriors. By the late 1960s this sort of public interest had waned.

Apart from Blackwood's early work, more scholarly publications did not emerge until the late 1950s when Craggs et al. (1958), Fetchko (1972), Fischer (1959, 1961, 1963), Godelier (1969, 1971, 1986) and others sporadically published a variety of monographs. Curiously, interest in the Kukukuku amongst anthropologists has, until late, never been as great as that in the Enga.

Possibly the best description of the Kukukuku at the time of initial contact comes from J. K. McCarthy. McCarthy's encounters in the 1930s were principally with Kukukuku men and he described their appearance in detail.

> Around their middle they wore a skirt of heavy grass fibre which hung to their knees in front; their buttocks were covered with a strip of beaten bark cloth and many wore belts of linked cassowary bones. Across their chests they wore cross-belts of bright yellow beads made from the seeds of a plant. On their left arms they wore the bowman's wrist covering to protect them from the cut of the relaxed string.
>
> The sides and front of their heads had been shaved by their sharp bamboo knives but a top-knot was left at the crown of the skull. From this was hung a cloak of beaten bark, which hung to the back of the knees. This covering - the *mal* – served two purposes, as a protection against the bitter winds and rain of the mountains when it was drawn tight around the wearer, or as a method of camouflage when they put it over their bodies and stood motionless. This camouflage was very effective – even close up you could not be certain whether it was a man or a tree stump you were looking at.
>
> Their bows were of blackwood palm, short but powerful, and the strings were of cane. The arrows were also short, undecorated and unbarbed, although some were heavily notched at their palmwood heads. Some too, had tips of sharpened bone while others had the wide sharpened blades of bamboo fitted. These last were generally used for pig-hunting, when the wide blade would cause the animal to bleed a great deal and so fall from exhaustion. A stone adze or stone club completed their arms, the clubs being masterpieces of workmanship. The polished stone heads followed several designs. Some were notched in small squares like a Mills Bomb; some were star shaped, some were cut like gear wheels. The more utilitarian clubs were plain globes about the size of a cricket ball and drilled through to take the wooden handle; others were flat circles of granite. The clubs were often carried hidden in their waist bands and

> covered by the long cloak that hung behind; they were able to jerk them out like lightning.
>
> Each man had the septum of his nose pierced and through it he wore a short piece of white bone or bamboo. Their expressions were almost always fierce and truculent. Even their language sounded as though the speaker was in a raging temper; the words began slowly but each sentence became faster so that at the end it was a high-pitched torrent. This description of tribal dress was common to all Kukukuku. It remained the same from the central ranges of New Guinea to the hinterland of the Papuan Gulf (McCarthy 1963: 97).

Beatrice Blackwood, who had carried out fieldwork amongst the Kukukuku of the Upper Watut River area, about 50 kilometres northeast of Menyamya, in 1936–7 provided an early description of the clothing of the Kukukuku women:

> The women wear a skirt which is fuller and longer than the men's sporran. The skirt has a back and front leaving the flanks bare. The skirt is made of shredded bark . . . Little girls begin wearing these skirts much earlier than boys begin wearing their sporrans. Tiny ones not more than an inch or two long are seen on babies who can scarcely walk (Hallpike 1978: 45).

Blackwood noted that the women also wore the ubiquitous bark cloak, fastened in the same way as the men's, as well as a variety of ornaments, including belts, necklaces and armlets, many of which featured the bright yellow stems of orchids (mistaken by McCarthy as seeds). The women did not pierce their noses but, like the men, pierced their ears and inserted the pliable wing shaft of a cassowary upon which, when bent back on itself and secured, served as a loop for suspending shells and other objects. The women, like the men, also carried small net bags for transporting useful items such as fire lighting equipment (Hallpike 1978: 46).

The Kukukuku, like the Enga, were bush-fallow cultivators of sweet potato and taro but they kept few pigs and did not have any exchange systems based on pigs, shells or other valuables. As a consequence they had no 'big men' or chiefs and their leaders were generally the more skilled hunters or warriors. They were sophisticated hunters, using bird-hunting platforms and elaborate traps. They were a part of several trade cycles and used clay pots which came to them from the Markham Valley via the Lower Watut (Hallpike 1978: 2).

Blackwood is somewhat dismissive of the Kukukuku's technological skills but this seems to be related to their disinterest in decorative art. Certainly, as Freund testifies, their skills in making the practical articles needed for daily existence, and particularly salt manufacture, were quite sophisticated.

This lack of interest in decorative art sets the Kukukuku apart from everyone else in Papua New Guinea and, indeed, the whole Pacific region. There are other distinctions also. The blood pattern found in a representative sample of 111 Kukukuku in the late 1950s did not resemble that reported from anywhere else in New Guinea. Thus Craggs et al. (1958: 70) suggested that the Kukukuku may represent a group of people distinct from both the Highland and the Coastal people of Papua New Guinea. The Kukukuku languages are also relatively distinctive. There are about 12 Kukukuku languages similar enough to form a linguistic stock but, on the basis of Wurm's 5 – 12% cognatic association rule, the Kukukuku speak a language which is quite different to that of their neighbours (Hallpike1978: 1). Lloyd (1973: 96) suggested that further work had to be done on the Kukukuku language before a definitive case could be made for its context in the Melanesian language family. Recent work by Foley et al. seems to be providing this basis.

Group boundaries amongst the Kukukuku tend to correspond to dialect boundaries, but do not seem to have any other function. The Kukukuku social unit is an agglomeration of contiguous hamlets, each hamlet consisting of six to ten houses. This association is seldom fixed because local politics tends to cause shifting allegiances.

Editor Of Pidgin Literature At Luther Press, Madang

By 1965 Freund had reached 58 years of age and the constant walking had begun to take its toll. In May of that year he decided to take up a post at the Yorketown-Minlaton Parish in South Australia. Dora's aging mother needed care and Freund thought the time had come to leave New Guinea. After 14 years at Menyamya the Freunds left for Australia. Freund was presented with 6 arrows by a leader at Kwaplalim village as a farewell gift.

While at Menyamya, even though he was flat out running the mission, Freund had sat up at night printing and binding Bible stories which he had translated into *Tok Pisin* (Pidgin English) for his evangelists to use in the villages. These first

rough booklets eventually became the standard Bible story text throughout Papua New Guinea for the Lutherans and other denominations. At one stage, whilst on furlough, he had volunteers at Gawler in South Australia roneoing and binding copies for him (Anonymous 1964). The Lutherans initially had an aversion to *Tok Pisin* and had used *Yabem*, from the people around their first station at Simbang near Finschhafen, and then *Kotte*, from the people at Sattelburg (Flierl 1937: 14). Freund, being a pragmatist, began using *Tok Pisin* on Rooke Island when he discovered it was widely used and the people had difficulty with *Yabem*. Eventually the rest of the Lutherans fell in line with him.

On the basis of this work he was recalled from Australia and returned to New Guinea on 29 May 1968 as Editor of Pidgin Literature with the Luther Press at Nagada, near Madang. Under Freund's editorship the Luther Press not only produced religious tracts but booklets on recreation and games, running a business, keeping fowls, growing vegetables, fish farming, soil care, growing rice, caring for goats and the proper care of pigs.

Retirement

Finally, in 1976 when he was 69 years old, Freund decided to retire. He and his wife visited Menyamya between 22–26 April , where Russ and Selma Weier and a Dutch nurse, Adrienne Hoogvliet, were the only European staff left. Russ took Harold and Dora out to Concordia and Kwaplalim in his Landrover for a final look around. The Freunds arrived in Cairns on their way home on 28 May 1976. After a brief holiday, Harold began a series of stints as relieving Pastor all over south-eastern Australia. In 1983, when Dora was eighty, they decided 'enough was enough' and retired again, this time for good!

Collecting The Material

In early April 1950, whilst at Yaramanda, Pastor Freund sent the South Australian Museum a wig cover, made from the cocoon of a colony of moths. Freund had been intrigued by the wig cover and thought the Museum might be interested in it. He had no real intention of supplying further material to the Museum until Tindale wrote back to him on 12 April of the same year, pointing out that the Museum Board

> has been able to find some funds so that interested observers could collect material on our behalf at cost and have them shipped to us for permanent preservation.

Pastor Freund did not ship any further material to the Museum at this stage but with Tindale's letter in mind collected a range of interesting objects. On 23 February the following year, while he was in Australia on furlough waiting for a permit to enter the Menyamya area, he visited the Museum and donated these objects, along with related ethnographic information, to Tindale for inclusion in the Museum's collections.

During the same visit Freund showed Tindale a stone club which he had collected at Menyamya in Kukukuku country during his first visit there. Freund did not donate the club to the Museum but allowed Tindale to sketch it and take notes. Tindale was very interested in the prospect of obtaining material from Menyamya because it was close to the area he had visited during the war and had read about in Beatrice Blackwood's 1939 article in the 'Geographical Journal'.

The first consignment from Pastor Freund was despatched from Menyamya on 8 July 1951 with a letter to Tindale which said,

> I decided to send you a trial package of material from our Kukukukus. Both Customs and Health Authorities keep an eagle eye on any such things entering Australia. So I am interested to hear when, in what condition, and with what difficulties you get the package.

Thus began a series of shipments which would continue for several years. As material arrived Tindale and the Museum Director, Herbert Hale, wrote back to Freund with useful information related to the identification of the materials used in the artefacts and providing copies of articles gleaned from reports and publications not available to Freund. On 26 March 1952, for instance, Tindale wrote to Freund and included information about the reeds the Menyamya people used to make mens' sporrans:

> I have just received an identification of the reed which the natives of your area use for the making of grass skirts. It has been identified for me as *Eleocharie dulcis* which grows from Brisbane north through New Guinea and the East Indies to India. The reed is widely cultivated, being used as a food root as well as medicine. I enclose an extract from a book by William Roxburgh entitled 'Plants of the Coast of Coromandel' dated 1819, which gives an account of the plant. In that book it is called *Scirpus tuberosus* but it is the same species.

Inevitably, Tindale also had specific questions

about the use and manufacture of items and Freund endeavoured to answer these in his return letters.

Freund, with a naturally inquisitive mind, not only provided these details but also sent Tindale samples of raw materials and objects in various stages of manufacture. As this process developed, the Museum slowly acquired a unique collection from a unique group of people in an area which had only just been effectively opened up to the world at large. Following Freund's departure, Tindale made contact with L. Howie, a builder working for the Catholic Mission at Wabag, and arranged to buy more Engan artefacts for the Museum.

Inspired by the material arriving at the Museum from collectors like Freund, Tindale was keen to conduct his own expedition to the Highlands and began to press the Museum Board for funds. In April 1950, he wrote to Freund requesting details of the conditions in the Wabag area.

> Would it be possible for you to inform us about general facilities for visiting the Wabag area and any possibilities for say an individual researcher to stay in the vicinity for a period of from four months to eight months at reasonable cost?

Despite his best efforts the Museum Board remained unconvinced by Tindale's arguments and declined all of his annual requests for the funding of an expedition. By 1955, obviously frustrated by his lack of success, Tindale went to the press. At the time, a series of reports had appeared in both local and interstate newspapers related to the discovery of the so-called Shangri-la Valley in the Central Highlands and Tindale again stressed the need for a Museum expedition. His subsequent entreaties to the Museum Board were again unsuccessful and he made no further requests for funding. He did, however, maintain his interest in the area and continued to correspond with collectors like Freund. He also collected copious notes and press clippings on the area right up until the late 1960s. It is interesting to speculate how the Museum's New Guinea collections would have developed if Tindale had been allowed to carry out his own collecting programs. The Museum's first expedition to New Guinea since Edgar Waite's of 1918 did not occur until 1968–9 when Graeme Pretty and Tony Crawford collected material from the Southern Highlands and the Western District.

Documenting The Collection

In 1994 I resigned from the Aboriginal Heritage Branch in Adelaide, where I had been the Registrar of Sites, and took up part time consultancy work. This change of pace has allowed me to pursue a number of personal interests. Before joining the Branch in 1974 I had been a Patrol Officer and Publications Officer in Papua New Guinea and I have maintained an interest in the area ever since. I have returned there to work on several occasions, most recently this year. In 1995 I approached the South Australian Museum with a view to assisting, on a voluntary basis, with research related to their Papua New Guinea collections. The Curator of Foreign Ethnology, Barry Craig, thought that, given my experience in particular areas of Papua New Guinea, the Freund material and related collections would be appropriate for me to work on.

Locating Pastor Freund was relatively easy. I simply looked up A. P. H. Freund in the Adelaide Telephone Directory and there he was with an address at the Lutheran Homes in Payneham. A few discrete enquiries ascertained that he was in good health and very probably interested in helping with the collection.

As it turned out Pastor Freund had been helping with the setting up of a Lutheran New Guinea Mission Museum at Hahndorf, writing copious notes for the collection, which had accumulated at the Lutheran Church offices in North Adelaide over many years. I arranged to meet him at the South Australian Museum and showed him the accession cards and copies of his photographs. He was mildly surprised to see this material because it had been over 40 years since he had donated it to the Museum and he had forgotten about it.

When we visited the Museum's off-site storage facility at Netley the following week and looked at the artefacts, many of which bore tags in his handwriting, Pastor Freund was convinced enough for us to get down to the business of inspecting each item and recording his observations and memories of it. Pastor Freund was very thorough, a trait which carried him through his years as a missionary, coastwatcher and editor. He took the transcripts of our conversations about the artefacts home with him and checked, reworked and added to them until he was satisfied that the information (and grammar and punctuation) was accurate. We reworked the final transcript, over 30 pages, several times before he was satisfied with it.

During the process of making the transcript, I endeavoured to locate as much relevant information about Engan and Kukukuku material

culture as possible. Pastor Freund incorporated information from these sources into the transcript where he thought it was appropriate or where his memory failed him. On one occasion he called in the Kleinigs, who had worked with him in New Guinea and now live in Adelaide, to verify the names and uses of some of the items. As we worked our way through the collection I photographed each item in monochrome with a scale and its relevant accession number.

The system of recording accessioned items in the Foreign Ethnology Collection at the Museum was in the throes of being updated and computerised during the time of the making of the transcript and a few items could not be easily located. On occasion I had to skim through photocopies of shelf lists hoping to spot elusive objects. When this failed Pastor Freund and I physically searched the shelves looking for the items in the most likely places. Similar items are grouped together on the shelves at Netley rather than being grouped by collector. We actually found his Menyamya arrow collection, one arrow at a time, over a period of several hours by this method. As we progressed we were able to amend incorrectly numbered items and shelf locations for the computer record. We left his arrows on one shelf in one loose bundle in case we needed to go back to them later on.

Pastor Freund was over 90 years of age and his stamina and attention to detail during the above process was, for someone a little over half his age, somewhat humbling. During the period of compiling the transcript his wife, Dora, passed away and his son Martin, also a Pastor, retired because of ill health and moved to Adelaide with his family. Despite these events we completed the transcript over a period of about 9 months, working one day a week.

Discussion

Freund did not despatch all of the material that he collected to the South Australian Museum. His correspondence with Norman Tindale tended to pursue particular lines of interest and this influenced the types of items he sent to the Museum. On 12 April 1950, for instance, Tindale provided information on the species of moth from which the wig cover, which Freund initially sent to the Museum in 1950, was made. The return correspondence from Freund provided more details on wigs and their construction and the news that he had collected more samples, as well as other related items, such as pins and decorations, which he would deliver to the Museum when the opportunity arose. While Freund was interpreting from Tindale's letters the types of items which he thought the Museum would be interested in, and duly collecting these, he was, at the same time, collecting other items which were destined for other purposes.

During furloughs in 1950–51, 1953–54, 1958–59 and 1963–64, the Freunds travelled extensively in Australia lecturing and showing slides and films of their mission work at Menyamya. One of the aims of these lectures was to raise much needed funds but, for the most part, Freund was keen to show people in Australia that the efforts of the missionaries in New Guinea were worthwhile. To assist with the process of generating interest in the mission's work, Freund also took artefact collections around to show his audiences. At the end of each furlough he disposed of these collections to friends and other interested parties, rather than store them or carry them back to New Guinea.

Between 11 November 1953 and 15 August 1954, the Freunds lectured in both Australia and New Zealand. In 1954, Harold gave one lecture in Sydney and then travelled to Queensland where he spoke at seventeen different venues (Freund 1985: 158). On 13 August, near the end of the furlough, he visited the Director of the Queensland Museum, George Mack, and donated most of his touring collection to the Queensland Museum. Mack had attended one of Freund's lectures and had expressed an interest in the collection. One of the donated items, a stone club-head, originally had a handle but Freund had separated the two components on the train up from Sydney to make it easier to carry and had left the handle in a luggage rack on the train; when he went back to find the handle it was gone!

The residue of the items which had not been given to friends or donated to the South Australian or Queensland Museums was eventually passed on to Christel Metzner and her husband, who have established the Louise Flierl New Guinea Lutheran Mission Museum at Hahndorf in South Australia. Christel added this material to a larger collection of Papua New Guinean artefacts which accumulated over many years at the Lutheran offices in North Adelaide. Pastor Freund assisted in sorting and labelling this material.

While most of the items which Freund collected at Yaramanda are held by the South Australian Museum, its Menyamya collection is essentially

part of a larger collection shared by the Queensland Museum and the New Guinea Lutheran Mission Museum. These collections, however, do not exhibit the range and variety of the Freund Kukukuku material held in the South Australian Museum. There are twenty six Freund items in the Queensland Museum, fourteen of which are chestbands, four are armbands, and three are plaited belts. The rest of the collection comprises two necklaces an 'apron', a 'mat' and a clubhead (Queensland Museum, Oceanic Anthropology Collection 1997). Apart from a few items Freund has had difficulty distinguishing which Kukukuku items in the Lutheran collection are his and which come from other collectors.

A distinguishing feature of the South Australian Museum collection is the amount of ancillary material, in the form of photographs and information, provided by Freund. There is no similar level of data accompanying the Freund collection in Queensland and the New Guinea Lutheran Mission Museum collection is accompanied by much more generalised information. Unfortunately Freund was unable to provide any further information, beyond his original captions, for the photographs.

Apart from the information recently provided by Pastor Freund, the credit for the compilation of the South Australian Museum data on the Freund collection must go to Norman Tindale. He pursued Pastor Freund for copies of photographs and elicited other information from him by letter and during their meetings when Freund delivered material to the Museum. This data is dispersed in Tindale's journals and in the South Australian Museum Anthropology Archives, but when brought together provides a surprisingly useful accompaniment to the artefact collection.

The Freund collection in the South Australian Museum contains approximately seventy items from the Laiapu Enga at Yaramanda but only twenty items from the Kukukuku at Menyamya. The rest of the collection comes from Wabag, Mount Hagen and Umboi. The Yaramanda collection contains mutiple examples of specific items, such as wig covers, but the examples of artefacts-in-preparation makes it very interesting and it stands up well against the other Museum collections from the Highlands, such as the Howie collection from near Wapenamanda and the Alpers collection from the Eastern Highlands.

Little is known about L. Howie. He was a lay worker with the Catholic Mission. In 1950 he had donated a number of 'sorcerer's charms', a comb and a dyed skirt from Orokolo, west of Kerema, to the Museum. When Tindale learned that Howie was going to Wabag he arranged for the purchase of a number of specific artefacts 'at cost' for the Museum. This collection comprises twenty nine items from Wapenamanda, not far from Yaramanda, purchased in 1951 'by arrangement' with the South Australian Museum.

The majority of the artefacts which Howie collected for the Museum closely duplicate those supplied by Freund. The Museum records provide no hint of the rationale Tindale used for this duplication He does not appear to have been trying to fill in the gaps in Freund's collection nor was he simply picking up where Freund had left off. The only distinctive item collected by Howie for which there is not a Freund equivalent is a man's wig. Given Freund's interest in wig covers it would seem logical for Tindale to have sought an Engan wig for the Museum's collection but there is no record of such a direct request in the Museum's records. Tindale was careful not to mention to either Freund or Howie that he was receiving artefacts from both of them or that he was duplicating some of their material. At the time of the collections Tindale was putting the finishing touches to the refurbishment of the Pacific Islands Gallery and he may have been seeking specific items to illustrate the themes he was developing for the individual displays, although none of the Freund or Howie material was used there. There is no doubt that there was some sort of system in Tindale's collecting activities but its exact nature now seems to be lost in time.

Although Tindale had an abiding interest in the Wabag Valley and was insistent that the artefacts should be purchased 'directly from natives', rather than through a third party, his interest was mostly 'scientific' and he did not seem to have much feeling for their intrinsic value. Tindale did not object when Howie advised him that he would have to cut all of the arrows and spears he had collected for the Museum into three convenient pieces before mailing them. Tindale later advised the Methodist missionary, Ralph Lawton, to carefully break a number of earthenware pots from Kiriwina in the Trobriand Islands into suitable sized pieces before mailing them because he knew they would probably be broken in transit anyway and controlled breakages would make for easier reassembly.

The collection donated by Dr Michael Alpers comes from the Fore people of the Eastern Highlands. Dr Alpers worked extensively in this area researching the causes of *Kuru*, the so-called

TABLE 1. Yaramanda Artefacts – Comparison With Other South Australian Museum PNG Highland Collections **1**–Freund (Yaramanda), **2**–Howie (Lai Valley)+, **3**–Alpers (Fore/Eastern Highlands).

Stone, Bone & Other Tools	**1**	**2**	**3**
Grindstone			*
Axe	*	*	*
Adze			*
Bark Beater			*
Hammerstone			*
Scraper			*
Core (for flaking) [NB., but no flakes in collections]			*
Chisel			*
Sharpening Stone			*
Needle – bone	*		*
Weapons/Hunting Gear	**1**	**2**	**3**
Spear	*	*	
Shield			*
Bow	*		*
Arrow – plain palm	*	*	*
Arrow – bamboo blade	*	*	*
Arrow – pronged		*	*
Arrow – bone tipped	*		*
Arrow – barbed	*	*	*
Trap – bird			*
Ceremonial Objects	**1**	**2**	**3**
Ochre/Paint			*
Stones – magic			*
Bow – magic			*
Arrow – magic			*
Ornaments	**1**	**2**	**3**
Wig		*	
Wig Cover	*	*	
Head Dress – feather		*	*
Hat – cassowary feather	*		
Pin – Bone	*	*	
Pin – Wood	*		
Necklaces	*		*
Armlet	*	*	
Legband	*		
Headband	*		*
Waistband			*
Nosepieces			*
Clothing	**1**	**2**	**3**
Cloak			*
Apron – Male	*	*	
Rain Mat	*	*	
Tapa Cloth	*		
Belt Plaited	*		
Skirt – Female	*	*	

TABLE 1. (cont.)

Narcotics, Musical Instruments & Toys	1	2	3
Smoking Pipe			*
Flute			*
Jews Harp	*		
Drum			*
Spinning Top			*
Ball – Banana Fibre	*		*

Household Items	1	2	3
Basket	*		
Small String Bag	*		*
Rope	*	*	
Fibre – rope making		*	
String	*		*
Large Net Bag (bilum)	*	*	*
Head Rest			*
Salt	*		
Salt Making Gear			*
Gourd – Water	*		
Bowl – wooden			*
Cup – coconut			*

* Collected 4 miles west of Wapenamanda (Yaramanda is about the same distance east of Wapenamanda).
L. Howie provided Enga names for artefacts collected on behalf of the South Australian Museum.

'laughing disease', transmitted by the consumption of human brain tissue. The collection is very large, comprising some four hundred items. Of these, two hundred and seventeen are stone axe blades. The rest of the collection is comprised of a significant number of other stone tools, such as chisels, hammerstones and sharpening stones, and a variety of magical, household and other items, including arrows and items specifically related to *Kuru*. An analysis of these three collections highlights the effects of individual collectors' interests (see Table 1).

Doctor Alpers has expressed an intention to work on his collection for the Museum. The Howie collection, although small, also deserves attention because, like the Freund collection, it was made during the early days of contact in the Papua New Guinea Highlands and could be coupled to an historical perspective of the Catholic mission there, which differed somewhat in approach from the Lutherans.

The Museum only has one other Kukukuku collection; this was collected by Roger Teusner in 1969 and donated in 1981. Although Teusner collected his Kukukuku material from three villages near Concordia he also collected a few items elsewhere. He also acquired artefacts from people in the Barossa Valley in South Australia, where many Lutheran families with connections to Papua New Guinea live. His Kukukuku collection is representative and in good condition, possibly because some of it was specifically made for him. Teusner has provided a number of photographs and notes related to this collection which makes it a valuable addition to the Museum's collections. A cursory comparison with similar items in the Freund collection shows the influence of steel tools during the years between 1952 and 1969, with neatly cut edges on skirts and distinctive steel blade marks on wooden artefacts.

Although the provenance of individual items in Teusner's collection have now been confirmed, it initially presented a number of confusing elements. His collection of arrows, for instance, included a number of barbed heads and a type of binding different from the distinctive style of the Kukukuku. As it transpired, his arrow collection had been given the overall provenance of Menyamya but included several which he had collected elsewhere. The ascribing of Menyamya as the provenance for the whole collection was

TABLE 2. Kukukuku Material Culture – Comparison of Australian Held Collections to Pitt Rivers Museum Collection.
1–Pitt Rivers Museum (Blackwood), **2**–Queensland Museum (Freund et al), **3**–MacLeay Museum (Thompson), **4**–SA Museum (Freund, Teusner et al), **5**–Victoria Museum (Altus et al), **6**–Lutheran Museum (Freund).

Stone Tools	**1**	**2**	**3**	**4**	**5**	**6**
Grindstone	*					
Adze	*	*	*	*	*	*
Bark Beater	*		*	*	*	*
Hammerstone	*					
Scraper	*					
Flake	*					
Bone & Other Tools	**1**	**2**	**3**	**4**	**5**	**6**
Awl	*		*			
Plane	*					
Drill	*					
Weapons/Hunting Gear	**1**	**2**	**3**	**4**	**5**	**6**
Club (wood)	*	*		*		*
Shield	*					*
Bow	*		*	*	*	
Arrow – plain palm	*		*	*	*	
Arrow – bamboo blade	*	*	*	*	*	
Arrow – pronged	*		*	*	*	
Arrow – blunt	*		*		*	
Arrow – bone tipped	*					
Club (stone) – ball	*		*	*	*	*
Club (stone) – disc	*		*	*		
Club (stone) – star				*	*	*
Club (stone) – pineapple	*		*		*	
Club (stone) – diamond		*				
Ceremonial Objects	**1**	**2**	**3**	**4**	**5**	**6**
'Marita' Initiation Tray	*					
Bull-roarer	*					
Ochre/Paint	*					
Ornaments	**1**	**2**	**3**	**4**	**5**	**6**
Necklaces	*	*	*	*	*	*
Armlets	*	*	*		*	
Headbands	*					
Ear Rings	*					
Nosepieces	*		*	*		
Clothing	**1**	**2**	**3**	**4**	**5**	**6**
Cloak	*		*	*	*	*
Sporran	*	*	*	*	*	*
Bark Back Cover	*					
Baldric (Chestband)	*	*	*		*	*
Skirt	*		*	*	*	*
Belt	*	*	*	*		

TABLE 2 (cont.)

Narcotics	**1**	**2**	**3**	**4**	**5**	**6**
Pipe	*					
Lime Gourd	*					
Tobacco Dryer	*					
Musical Instruments	**1**	**2**	**3**	**4**	**5**	**6**
Flute	*					
Pan Pipe	*					
Jews Harp	*		*			
Drum	*					
Medicines	**1**	**2**	**3**	**4**	**5**	**6**
Clay	*					
Red Earth	*					
Prickers	*					
Bark	*		*			
Toys	**1**	**2**	**3**	**4**	**5**	**6**
Bark Cloth Figure	*					
Reed Toy	*					
Spinning Top	*					
Bow & Arrow	*					
Household Items	**1**	**2**	**3**	**4**	**5**	**6**
String	*					
Rope				*		
Knife	*		*			
Digging Stick			*			
Broom	*					
Spoon	*					
Pot (clay)	*					
Fire Tongs	*					
Torch	*					
Firemaking Kit	*					
Small Net Bag	*		*	*	*	
Large Net Bag (bilum)	*		*	*		
Head Rest			*			
Salt	*		*	*		
Mat		*				

Note: The above table is necessarily approximate. In some cases not enough detail is available to positively ascribe an object to a particular category. In other cases a variety of items are placed in one category despite their variations eg. necklaces. Other items described in printouts from the various institutions as Kukukuku are obviously incorrectly provenanced, barbed arrows ascribed as Kukukuku for example. It is important to be aware that the types of artefacts listed in Table 1 do not represent a complete material culture inventory of the people described as the Kukukuku. Blackwood's ethnography mentions other objects such as 'sun' and 'pronged' stone clubs, cassowary bone belts, bow wrist guards, lime spatulas, aeolian flutes and water carriers which are not represented in any of the collections surveyed.

also curious because the artefacts, in fact, came from three specific villages near Concordia, some distance to the north of Menyamya, and from an area slightly different linguistically.

Apart from this collection the Museum has only an adze, stone club, axe and package of salt from unknown parts of Kukukuku country donated by three different collectors.

There are few other Kukukuku collections held outside South Australia. A complementary, but smaller and less diverse, collection made by Owen Altus is lodged with the Museum of Victoria in Melbourne. About 150 Kukukuku items collected by Patrol Officer George Chisholm in 1913 and 1914, inland from the Gulf of Papua, were included in the Official Papuan Collection assembled by the Papuan Administrator, Hubert Murray, between 1907 and 1929. The Australian Museum took about 12% of the entire collection and the rest went, at Murray's request, to the Australian Institute of Anatomy in Canberra in 1934. In 1984 it was transferred to the National Museum of Australia. Chisholm provided only brief documentation on the tags he attached to his collection and it would be necessary to locate his original Patrol Reports to gain further information (Craig 1991: 54). The Derek Thompson collection, made chiefly at Menyamya in the 1980s and held by the Macleay Museum in Sydney (Macleay Museum 1986), is probably the most recent large Kukukuku collection. A useful summary of the various Papua New Guinea collections held in Australian institutions is provided by Bolton (1980).

Overseas, the Beatrice Blackwood collection at the Pitt Rivers Museum in Oxford (Pitt Rivers Accession Book: 36–81) is the most complete site-specific (Upper Watut) Kukukuku collection known to this writer. The collection made by Dr Carleton Gajdusek and held by the Peabody Essex Museum in Salem, Massachusetts, is extensive and is detailed in a thesis by Peter Fetchko (1972). Another significant collection is the Maurice Godelier Collection in Paris. The British Museum has a string bag, a bamboo pipe, a necklace and a shield collected at various times between 1907 and 1980 which are described as Kukukuku (British Museum Accession Book 1996). A lengthy film of the Baruya Kukukuku was made by Godelier and the Australian ethnographic film maker, Ian Dunlop, in the 1970s but is generally unavailable because of its depiction of initiation rites.

One of the consistent features of the South Australian Museum's Pacific Islands and Papua New Guinea collections, in common with other Australian museums, is the randomness of its individual collections. Since the museums could not undertake their own specific fieldwork, as Tindale wished to do in the New Guinea Highlands in the 1950s, they were subject to the whims and fancies of their various donor-collectors. Most of the collectors were men and this is possibly why there is a preponderance of weapons in the Papua New Guinea collections. All of the Australian museums have thousands upon thousands of arrows and spears from Papua New Guinea and the Pacific region.

The collection made by Beatrice Blackwood does not follow this trend however. With the exception of a few specific and more obscure items, Blackwood's collection is a considered representation of Kukukuku material culture (see Table 2). The Freund Kukukuku collection, taken in its entirety over the three repositories, makes a reasonable showing by comparison. There is no heavy emphasis on weapons and there is a considered attempt at finer detail. Freund was fascinated by the technology and skill of both the Laiapu Enga at Yaramanda and the Kukukuku at Menyamya. His notes on the manufacture of commodities like bark cloth and the details of weaving and string-making in the recently prepared transcript (1996) accompanying his South Australian Museum collection demonstrates his attention to detail. He has also provided excellent photographs and texts on items not in the collection, such as Umboi canoe-making, the development of *Tok Pisin* (Pidgin English) and the ceremonial life of both the Enga and the Kukukuku.

The problem with Freund's Kukukuku collection, of course, is the fact that it is spread over three institutions. The South Australian Museum has the bulk of the collection but there are a number of significant items lacking. The Museum does not have a Kukukuku shield, for instance, but there is one in the New Guinea Lutheran Mission collection. It would be useful to bring these collections together at some stage, but this possibility is unlikely, given the limited resources of the South Australian Museum. It would also be useful, using the Blackwood collection as a reference point, to attempt to locate samples of some of the other interesting Kukukuku artefacts lacking in the Freund collection, such as some of their stone technology, i.e. bark beaters, templates, stone flakes and chisels. These would be valuable additions to the collection and could enable a comprehensive exhibition of Kukukuku material culture to be mounted by the Museum in the future.

Chronology

1887 Freund's father Johann and his mother Anna take up land near Mt Mary, South Australia.
1907 Freund born on 6 July.
1925–6 G. F. W. Zimmer's Kukukuku photographs published in Papuan Report for that year.
1928 William McGregor encounters Enga people on the Yuat River during a patrol from the Sepik.
1931 German prospector Baum killed in Kareeba-Indiwi country together with eight of his Buang carriers.
1931 Mick and Pat Leahy attacked by Kukukuku.
1931 Pilot Trist dies in forced landing near Zenag.
1932 Clarius and Naylor, together with seven of their Buang carriers killed by Kukukuku.
1933 Patrol Officer J. K. McCarthy builds airstrip at Menyamya to service prospectors.
1933 Tommy O'Dea takes the first plane into Menyamya.
1933 No gold found and Menyamya closed.
1933 Freund graduates from Concordia College at end of year.
1934 Freund becomes Pastor at Arno Bay on Eyre Peninsula.
1934 Freund marries Dora Ey on 6 April.
1934 Michael Leahy leaves Mount Hagen on 11 June to explore the area to the west.
1934 Incident at Doi in Enga country on 25 June resulting in the killing of 15 people and the wounding of many others.
1935 Freund travels to New Guinea on Macdhui arriving Moresby in December.
1936 Freund settles at Awelkon on Rooke Island.
1936 Beatrice Blackwood starts fieldwork in the Upper Watut.
1936 The Lutheran missionaries, Lechner, Reiner and Maurer explore the country south of Wau.
1937 Blackwood finishes fieldwork in February.
1937 Patrol Officer Downs goes to Kobakini to set up base camp and is constantly harassed by Kukukuku.
1938 The Hagen-Sepik Patrol under the charge of James Taylor leaves Mount Hagen to explore the country to the Dutch border on 9 March.
1938 Martin Freund born in May in Gawler, South Australia.
1938 Taylor constructs a base camp and landing ground at Wabag during July.
1938 First plane lands at Wabag on 8 August.
1939 Taylor leaves Wabag on 7 June for Mount Hagen, arriving on 18 June.
1939 Roland Freund born on16 June at Finschhafen.
1940 Freund recruited as a coastwatcher by Eric Feldt.
1941 Dora and sons evacuated to Australia.
1942 Freund and other Lutherans join the New Guinea Volunteer Rifles at Lae.
1942 Wabag becomes a permanent Patrol Post.
1943 New airstrip built at Wabag.
1943 Freund discharged from Army in Australia in July.
1943 Tindale flies from Australia to Lower Watut to inspect downed Japanese planes. Obtains copy of Blackwood's article on the Kukukuku.
1946 Freund returns to Umboi (Rooke Island) and spends 18 months getting the mission back into shape.
1947 Ian Downs attacked by Siminapa Kukukuku on the upper Banir.
1947 Ogelbeng the most western Lutheran Mission.
1947 Seventh Day Adventists set up mission at Rakamanda near Wabag on 4 June.
1948 Catholics set up mission at Pompabus near Wabag in October.
1948 Freund and Kleinig set out from Ogelbeng on 23 August for Wabag Valley.
1948 Freund arrives at Yaramanda on 26 August.
1950 Freund leaves Yaramanda on 22 June.
1950 Decision made to reopen Menyamya.
1950 Hurrell leaves Slate Creek for Menyamya on 31 October.
1950 Hurrell and Keenan arrive on 9 November and clear old airstrip.
1950 Tindale gets funds from the Museum Board to purchase New Guinea artefacts.
1951 Freund visits Tindale on 24 February between leaving Yaramanda and going to Menyamya. Brings Enga material to donate to the Museum.
1951 Freund sends Tindale a 'trial' package of artefacts from Menyamya which arrives on 8 July.
1951 Freund arrives at Menyamya.
1952 Freund brings cattle into Menyamya on 25 November.
1952 Tindale selects photos from Freund's touring set and makes copies for Museum. Sends copies to Freund for annotation.
1954 First calves born at Menyamya.
1955 Deaconess Merna Thamm arrives at Menyamya to work with women.
1962 Concordia station established by mission 6 miles north of Menyamya. Missionaries build road to it.
1964 Freund moves out to Concordia on 16 June after the Jordans leave for Australia.
1965 Freund leaves Menyamya for Yorketown, South Australia.
1965 Last of the Kukukuku brought under Administration control.
1968 Freund returns to PNG to take up job as Editor of Luther Press at Nagada near Madang.
1976 Freund visits Menyamya on April 22–26. Only three European staff there.
1976 Freund leaves PNG and arrives in Cairns, Queensland on 28 May.

Figure 1. Salt manufacture at Menyamya. Bushes from the plant which produces 'Job's Tears' seeds are burnt and the ashes dissolved in water which is then filtered through fern leaves (mounted on a frame) into a bamboo pipe for drying in the sun or by a fire. Similar methods were observed by Freund at Yaramanda, although in the Mount Hagen area reeds soaked in saline pools were burnt (Photo by A. P. H. Freund – SAM Archives AP808).

Figure 2. A man from Yaramanda with a large bundle of salt wrapped in leaves (Photo A. P. H. Freund – SAM Archives AP670).

Figure 3. A small bundle of salt from Yaramanda collected by Freund for the South Australian Museum (Accession number A42379 – photo by P. Fitzpatrick).

Figure 4. A well-loaded woman at Yaramanda about 1949 with net bags full of sweet potato for sale. The woman also has a beaten bark cloak for protection from the sun and rain. The bark cloth covering her right breast has been soaked in fluids from the body of her dead husband and is being carried as part of the mourning process (Photo by A. P. H. Freund – SAM Archives AP778).

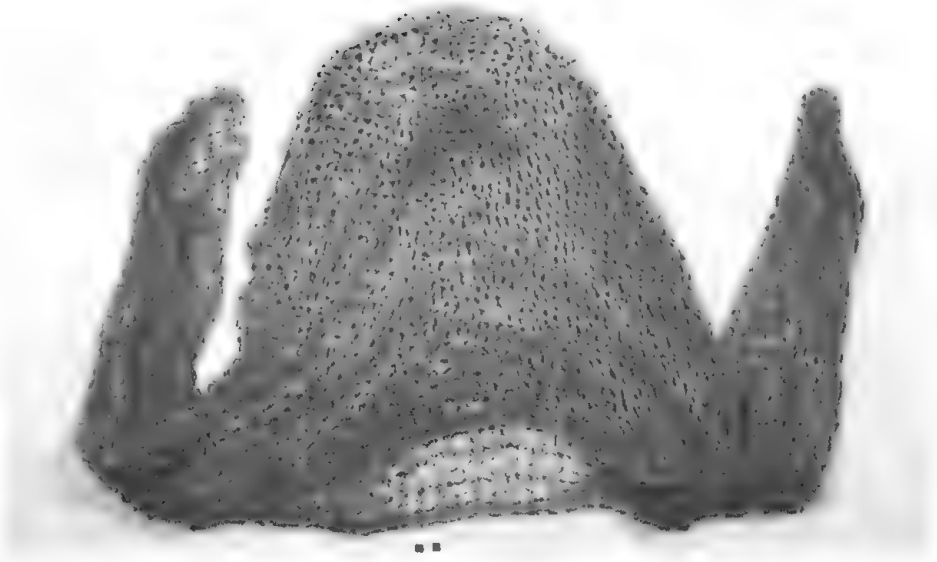


Figure 5. A net bag similar to the one shown in Figure 4 donated by Freund to the South Australian Museum (Accession number A42341– photo by P. Fitzpatrick).

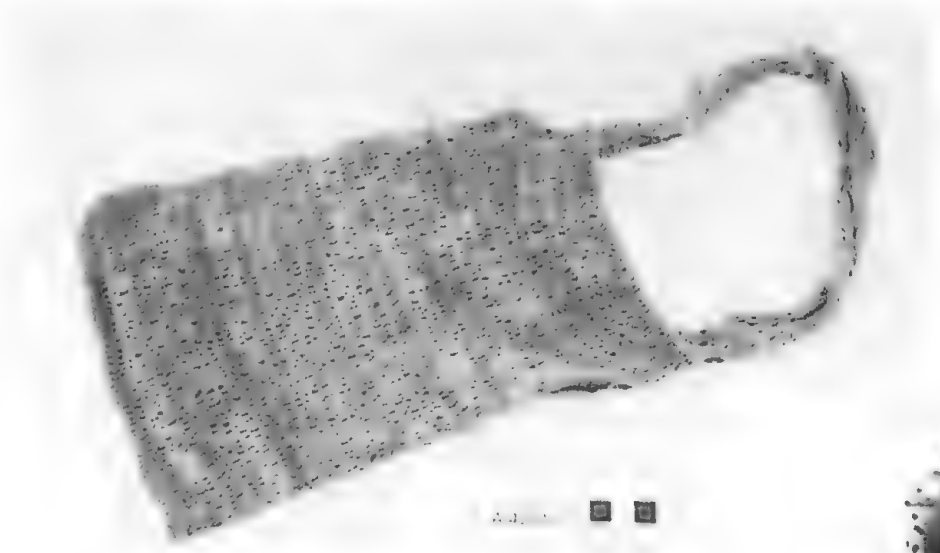


Figure 6. A man's net bag from Yaramanda. The use of such bags was almost universal in Papua New Guinea and the custom persists in many areas today. Kukukuku men carried similar bags (Accession number A42337 – photo by P. Fitzpatrick).

Figure 7. A Kukukuku man called Itamebiakavo from Kabag, about 9 kilometres east of Menyamya. He is wearing a bandolier made of bark fibre interwoven with yellow orchid stems. The bandoliers were often also worn as belts. Itamebiakaro was blinded in one eye by an arrow. The other decoration around his chest is a bandolier of cowrie shells (Photo A. P. H. Freund – SAM Archives AP769).

Figure 8. A sample of the type of bandolier shown in Figure 7 donated by Freund to the South Australian Museum. This bandolier measures over 30 metres in length (Accession number A42365 – photo by P. Fitzpatrick).

Figure 9. A sample of the type of orchid stems collected for interweaving into bandoliers like the one shown in Figure 7. This sample was collected by Freund specifically to accompany the bandolier shown in Figure 8 (Accession number A44632 – photo P. Fitzpatrick).

Figure 10. A typical Kukukuku 'sporran' or man's grass apron. Additional layers are added to create the bulging effect of the 'sporran'. The man is also wearing a fibre and orchid stem belt above his 'sporran'. The cassowary bones about his waist indicates that he is married and has at least one child. These bones were mistakenly described as human bones by early writers (Photo by A. P. H. Freund – SAM Archives AP799).

Figure 11. A sample of a Kukukuku man's grass apron or 'sporran' (as in Figure 10) donated by Freund to the South Australian Museum (Accession number A42794 – photo by P. Fitzpatrick).

Figure 12. A young woman from Yaramanda wearing necklaces of cowrie shells. These shells were used by the missionaries and government officers as currency but as more and more were brought into the area their value diminished (Photo by A. P. H. Freund – SAM Archives AP622).

Figure 13. A sample of the type of necklace shown in Figure 12 donated to the South Australian Museum by Freund. (Accession number A42358 – photo by P. Fitzpatrick).

Figure 14. A Kukukuku man called Tandatagagakata from Wiama village about 8 kilometres south of Menyamya. He is wearing a bark cape which is fastened by a drawstring to a tuft of hair deliberately left for the purpose on an otherwise shaved head (Photo by A. P. H. Freund – SAM Archives AP768).

Figure 16. Two men from the Mount Hagen area wearing beaten bark wig covers (Photo by A. P. H. Freund – SAM Archives AP631).

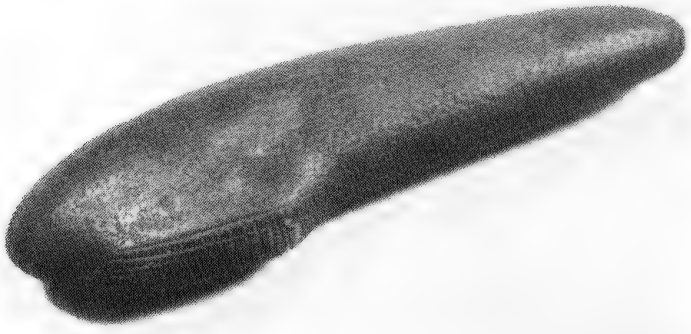


Figure 17. A sample of bark cloth used as a wig cover, collected by Freund at Yaramanada (Accession number A42343 – photo P. Fitzpatrick).

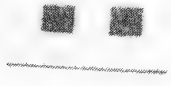


Figure 15. A stone beater used to make bark cloth. The bark attached to a Mulberry branch is beaten on a larger log and the crushed fibre sheet peeled off. This beater was collected by R. Teusner (Accession number A67591 – photo P. Fitzpatrick).

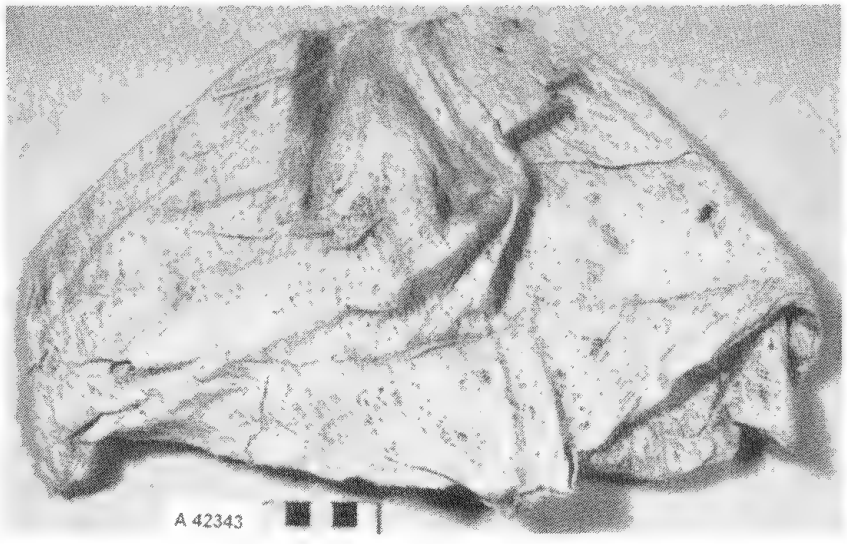


Figure 18. The method used to manufacture wig covers. Unlike the manufacture of bark cloaks, a small piece of Mulberry branch is used and the beater is of wood, rather than stone. A finer texture is achieved by beating the bark as thin as possible. The roughly cylindrical shape is drawn together at one end by string (Photo by A. P. H. Freund – SAM Archives AP662).

Figure 19. A man from Yaramanda dressed for his wedding ceremony. He is wearing an elaborate wig under a woven cover similar to the one shown in Figure 20. He is also wearing a large 'Baler' shell around his neck, bone pins in his wig, elaborate armbands and a specially woven fibre apron (Photo by A. P. H. Freund – SAM Archives AP634).

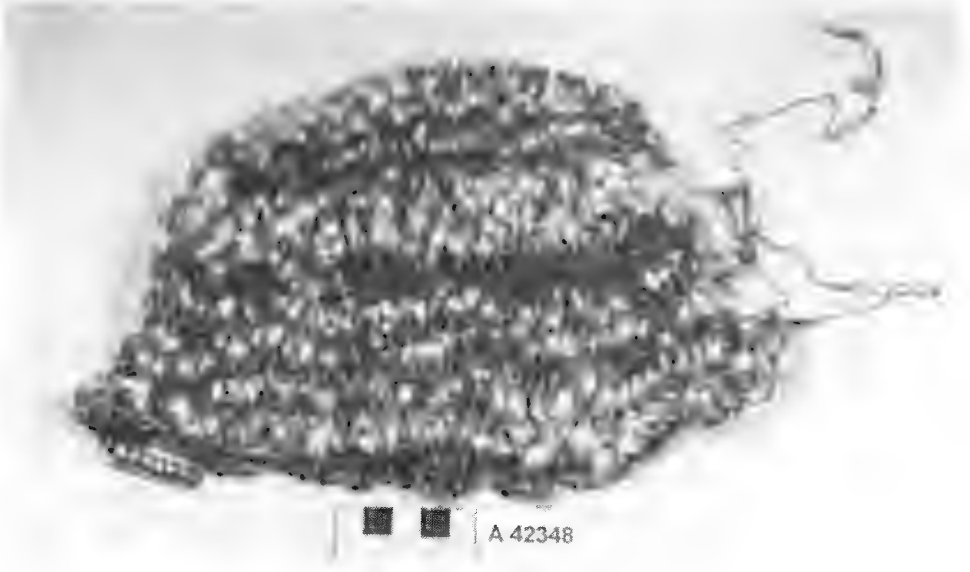


Figure 20. This type of wig cover is designed to be more decorative than protective and is generally worn during ceremonies such as the wedding for which the man in Figure 19 is dressed (Accession number A42348 – photo by P. Fitzpatrick).

Figure 21. A large gathering of people and pigs at Yaramanda for a pig exchange or Te'e ceremony (Photo by A. P. H. Freund – SAM Archives AP653).

Figure 24. Young woman at Yaramanda during the early stage of the establishment of the Lutheran Mission there. (Photo A. P. H. Freund – SAM Archives AP621).

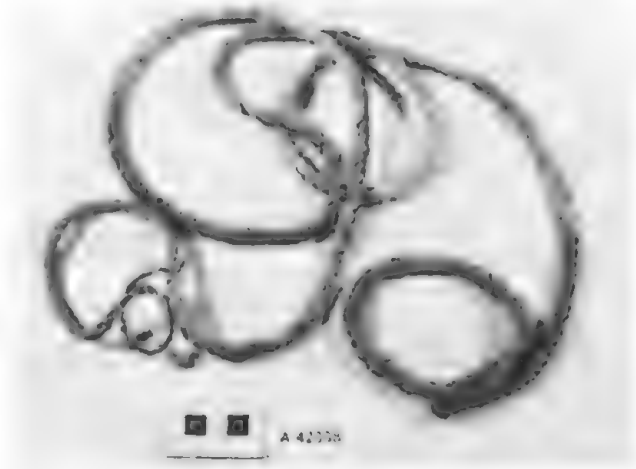


Figure 22. A sample of the special rope used during pig exchange ceremonies to fasten a pig by one leg to a stake. These ropes and stakes were part of an elaborate tallying system for the exchanges. This example collected by Freund is unused and was probably made especially for him to send to the South Australian Museum (Accession number A42338 – photo by P. Fitzpatrick).

Figure 23. Men's apron decorated with pigs' tails. Collected by Freund at Yaramanda (Accession number A42353 – photo by P. Fitzpatrick).

Figure 25. Mother and child at Yaramanda (Photo A. P. H. Freund – SAM Archives AP616).

Figure 27. The Dragon Rapide which brought the school teacher, Owen Altus, to Menyamya in 1951. He is standing with Pastor Horrolt and the pilot (Photo by A. P. H. Freund – SAM Archives AP815).

Figure 28. Pastor Freund with a group of Kukukuku men during the early establishment of the Lutheran Mission at Menyamya. (Photo A. P. H. Freund – SAM Archives AP805).

Figure 26. Some of the earlier Yaramanda Mission buildings overlooking the Lai River in 1948 (Photo by A. P. H. Freund – SAM Archives AP664).

Figures 29. Typical early Kukukuku visitor to the missionary camp in 1952. Few women came on these early visits (Photos by A. P. H. Freund – SAM Archives AP798).

Figure 30 The Menyamya Mission school teacher, Owen Altus, with a Kukukuku man. Altus is 1.84 metres tall. (Photo by A. P. H. Freund – SAM Archives AP766).

Figure 31. Pastor Scherle buying food at the camp boundary during an early exploratory trip a few kilometres out of Menyamya in 1952 (Photo by A. P. H. Freund – SAM Archives AP785).

Figure 32. A. P. H. Freund and the author editing notes on the collection at the South Australian Museum in 1996. (Photo by A. P. H. Freund).

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Apart from Pastor Freund a number of other individuals offered invaluable assistance during the process of researching the collection. Owen Altus and Reverend and Mrs Kleinig, retired Lutheran missionaries, come to mind, as does Doug Young from the Catholic Diocese of Wabag. Barry Craig, from the South Australian Museum, facilitated access to the collection and offered much needed technical and editorial advice. Kate Alport assisted with my various forays into the South Australian Museum archives. The curators of various museums and institutions holding Kukukuku and Enga material in Australia and overseas provided valuable data, especially Mike Quinnell from the Queensland Museum. Lloyd Hurrell graciously replied to my written enquiries, as did Doug Parrish of the Retired Officer's Association of Papua New Guinea. Mike O'Hanlon and Jim Specht read the draft and offered much valued professional advice.

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THE USHER PHOTOGRAPHIC COLLECTION FROM THE SOUTH-WEST PACIFIC

GRAHAME R. PIKE AND BARRY CRAIG

Summary

A collection of photographs was donated to the South Australian Museum in 1972. This collection includes around 630 photographs taken by Ernest Sterne Usher in Papua, New Guinea and the Solomon Islands. This paper reports research by the authors into the circumstances which gave rise to this collection and provides a brief description of the historical and cultural context of a selection of the images, with reference to some relevant ethnographic material in the Museum's collections.

THE USHER PHOTOGRAPHIC COLLECTION FROM THE SOUTH-WEST PACIFIC

GRAHAME R. PIKE AND BARRY CRAIG

PIKE, G. R. & CRAIG, B. 1999. The Usher Photographic Collection from the South-West Pacific. *Records of the South Australian Museum* **31**(2): 215–253.

A collection of photographs was donated to the South Australian Museum in 1972. This collection includes around 630 photographs taken by Ernest Sterne Usher in Papua, New Guinea and the Solomon Islands. This paper reports research by the authors into the circumstances which gave rise to this collection and provides a brief description of the historical and cultural context of a selection of the images, with reference to some relevant ethnographic material in the Museum's collections.

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Introduction

In 1995, Barry Craig, then acting Head of the Division of Anthropology at the South Australian Museum, was looking through cupboards at the Museum's Netley storage facility. Inside one he found a box containing photographs and nitrate negatives taken in Papua, New Guinea and the Solomon Islands. He took them back to his office in the Museum on North Terrace for a closer look. On further inspection it was discovered that the collection contained some remarkably clear images of considerable ethnographic interest.

The majority of the photographs (around 630) are the work of Ernest Sterne Usher, from 1914 to 1916 a Surveyor and assistant-Geologist with an oil exploration team in the Papuan Gulf region. Some of the images are similar to those which were taken by Frank Hurley in the same region five years later (Specht & Fields 1984).[1] A further 83 prints appear to derive from photographs taken in Papua by Evan R. Stanley, Papuan Government Geologist, and 24 prints of photographs taken in Australia by Leonard Langdale Wrathall, both of whom were members of the oil exploration team.

Also included in the Usher Collection are 33 postcards of Milne Bay and Trobriand Islands produced by W. H. Cooper of the Royal Arcade, Melbourne, twelve others of Papua printed in England for the Papuan Times Ltd, and 52 of the Solomon Islands produced by the Tasmanian photographer John Watt Beattie.

In November 1995, the authors began research on the Usher photographic collection,[2] a task that was particularly difficult as the only information accompanying the collection was Usher's brief description of each of the images and a copy of a letter dated June 1972 from the donor, Usher's sister, Mrs Edith Saxton of Melbourne.

Family History

Ernest Sterne Usher was born in 1887 at Fitzroy in Melbourne. His father was Frank Usher, his mother's maiden name was Mary Margaret Apps.

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[1] Other early collections of photographs taken in the eastern Gulf region are those by A. B. Lewis in 1912 whilst collecting for Field Museum of Natural History in Chicago; E. W. P. Chinnery in 1916, a Papuan Government Resident Magistrate in the area, whose photographs are held by his daughters in Melbourne; Paul Wirz in 1930, who carried out anthropological research in the region, whose photographs are held by the Museum für Völkerkunde in Basel, Switzerland; F. E. Williams, Government Anthropologist for Papua, during his fieldwork in the Purari region in 1922 and at Orokolo in 1931–2, whose photographs are held by the Australian Archives, Canberra, and by the South Australian Museum (see footnote 6).

[2] Grahame Pike began by developing a computer index of the photographs as a recipient of funding from the Commonwealth Rehabilitation Service. He continued with indexing, the location of relatives of Usher and the search for relevant documentation as a recipient of a research fellowship from the Friends of the South Australian Museum and continues the project currently as a volunteer researcher. Barry Craig, as Curator of Foreign Ethnology at the South Australian Museum, supervised Pike's research and provided additional text for this paper based on various ethnographic sources.

Family stories have Frank Usher and his brother Arthur travelling to Australia in 1879 as crew members aboard a cable-laying ship. Frank and Arthur did not sign on for the return trip when the ship eventually docked in Melbourne. Edith Saxton, one of Frank's daughters, thought that her father initially obtained work at Melbourne's Yorrick Club, although she was not sure of the position he held.

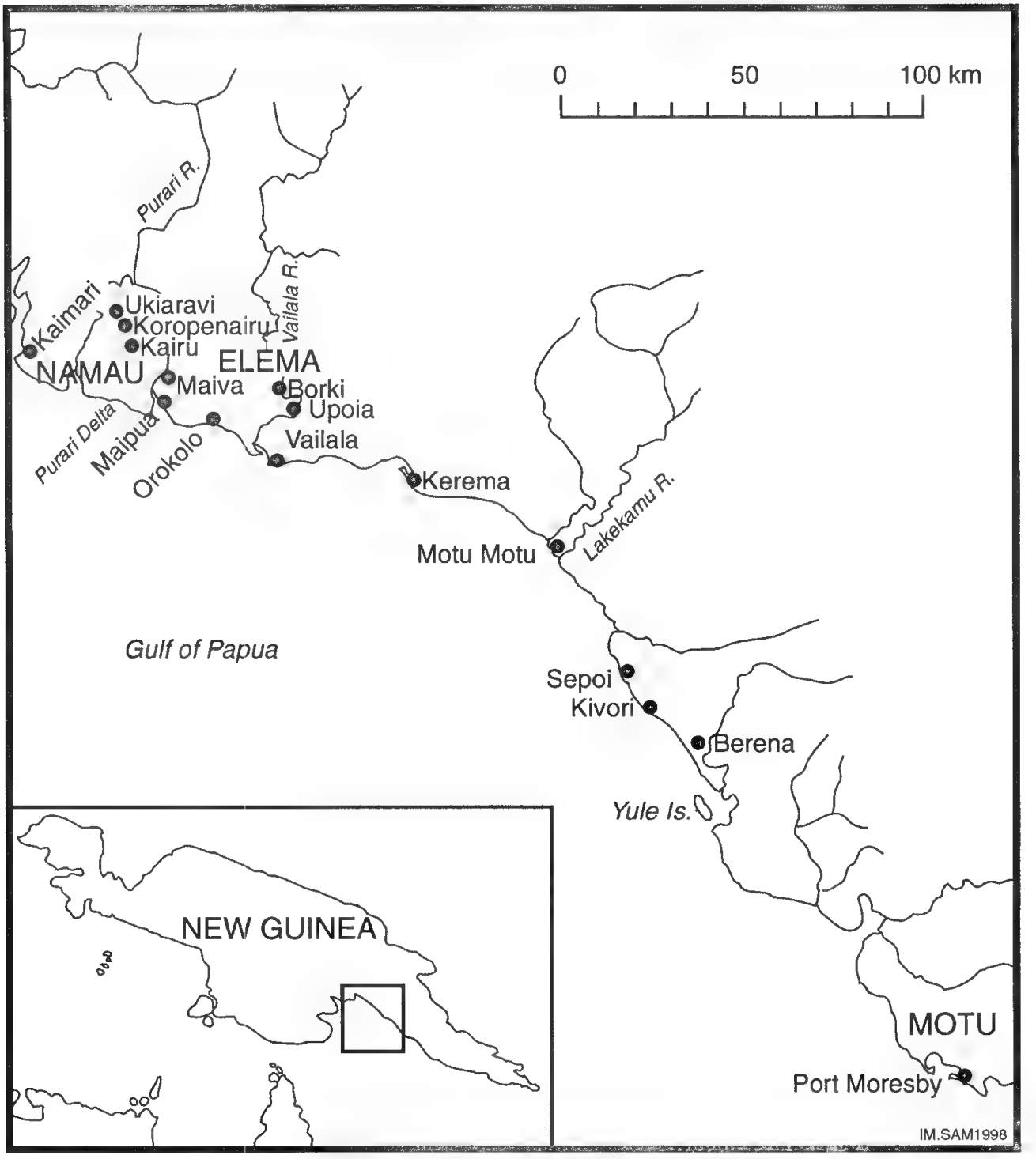
The earliest reference to Frank Usher is in the 1886 'Sands and McDougal Directory for Victoria', where he is shown to be living at 73 Moor Street, Fitzroy. He had married Mary Margaret Apps in 1881 when he was 20 years old. Frank and his wife moved into Moor Street and two sons were born; during the time they lived in Fitzroy a further four children, all girls, were born. Frank was taken into his father-in-law's business W. G. Apps Funerals, Moor Street, Fitzroy, eventually becoming a director. Frank Usher died at the age of 76 in June 1940.

Ernest attended school in Fitzroy and was, with his family, a regular at the local Parish Church of Saint Mark, George Street, Fitzroy. He took diplomas at the Working Men's College (precursor to the Royal Melbourne Institute of Technology) as a Municipal Engineer and Geologist. His first appointment was as Surveyor to the Water Supply Department. In 1908 he was Assistant Field Geologist in the Mines Department and in 1912 was stationed in Bendigo. While he was in Bendigo he attached himself to the Church of All Saints and acted on the Vestry, in the Sunday School, and as Scout Master. In 1913 he was chosen to join Dr Arthur Wade's oil exploration expedition to Papua; his loss to All Saints was greatly felt. He arrived on the Papuan field in January 1914. Following is an extract from Wade's 'Report on Petroleum in Papua' (1915: 5):

> At the request of the Government of the Commonwealth of Australia I, and my assistant, Mr L. L. Wrathall, B.Sc., A.R.S.M., left England in September, 1913, in order to investigate the geological features of the oil-bearing areas in Papua, and to report any conclusions to which I might arrive as to the methods of development which, in my opinion, should be adopted on these areas.
>
> We arrived in Port Moresby on the 15th October, 1913, and on the 17th proceeded to the Vailala River, where some work had already commenced. On the 19th October we arrived at Upoia, some 25 miles from the mouth of the Vailala River, where we were joined by Mr E. R. Stanley, the Government Geologist to the Territory of Papua, who had been instructed to assist us in the geological work. At Upoia we found that two shallow bores had been drilled by means of small hand boring plant by Mr Grebin, and abandoned for some time, whilst on the other side of the river at Orevi we found Mr Locke engaged in drilling with a larger and more efficient plant. We therefore decided to first examine thoroughly the geology of these two areas and then, with the knowledge so gained as a basis, to proceed westward towards the Purari River and endeavour to lay down some general structural lines, or at any rate to map any anticlinal features and to investigate any occurrence of natural gas and petroleum which may accompany such features. This being accomplished we were to return to the Vailala, and to work eastwards to Port Moresby with the same objects in view. We decided to map in detail all areas in which evidence of petroleum occurred on the scale of 12 inches to the mile. Later we found that so little was known of the districts through which we were travelling, and that the maps already published were so inexact, that it was necessary to fix our positions accurately by theodolite work, where possible, and to make an accurate traverse of the coast by theodolite and chain or stadia, so that the areas mapped could be placed in their proper positions with regard to the coast line. The arrival of two surveyors, Mr E. S. Usher, in January, and Mr J. W. Murray, in March 1914, assisted us greatly in this work.

Thus Usher and Murray were to assist first in the survey west along the coast from the Vailala through to the delta of the Purari River, and then along the Papuan coastline east of the Vailala as far as Port Moresby (refer Map P.217). Finally they would return for further work in the Vailala-Purari area. The photographs more-or-less follow that sequence with a date of August 1914 for their time in Port Moresby, coinciding with a visit there by the Admiral of the Royal Australian Fleet at the outbreak of the First World War. Back in the Purari-Vailala area, there is a 'Christmas 1915' date for a Purari expedition.

Perhaps early in 1916, Usher went on leave to Melbourne, sailing on board the 'Meklong'. From the sequence of the photographs, it appears that the Meklong called in at Samarai, then Herbertshoe and Rabaul, then sailed around the north and west of New Britain to Witu or Vitu (French Islands), and then south to Morobe on the southern shores of the Huon Gulf, then north-east to Ablingi and Lindenhafen on the south coast of New Britain, and finally due east to the Shortland Islands, Vella Lavella, Simbo Island, Gizo Island, Russell Island, Gela (=Nggela or Florida Islands), Tulagi Harbour and Guadalcanal in the Solomons. Presumably the ship then sailed directly to Brisbane and/or Sydney.



Map showing location of Vailala V-Purari area of the eastern Gulf of Papua.

Usher's Photographs

On his arrival at Upoia, Usher immediately began his photographic record. He preserved on film the living conditions, the characters, events and a view of native life that has since disappeared. **Album A** is a record from January to August 1914. He would have arrived by boat at the Upoia landing (**A8**) and been shown his quarters, and then taken on a tour of the camp.

The next morning he would have witnessed the general muster of the native workers and the inspection of the native police (**A7**). In his first days he took pictures of the main camp, native quarters, white quarters (**A5**) and of the terrain surrounding the camp site. In his Report, Wade describes Upoia (1915: 8):

> Upoia is situated in a basin-like depression surrounded on three sides by hills. To the north the hills rise in a precipitous escarpment to a height of 500 feet above sea-level. These hills curve round to the west, where they terminate abruptly in sago swamp. The Southern Hills are about half as high as those mentioned, while on the eastern boundary is the Vailala River, which here runs almost due south.

Towards the end of January 1914, Usher went from Upoia to Aro-Aro. He took a photograph of the departure (**A11**). Although the distance between Upoia and Aro-Aro is not great, the photograph shows a party of carriers in excess of 20, and a small contingent of native Police. They had to carry all their supplies for the duration of their stay, and for any exploratory side trips.

The camps set up by the survey teams were usually on the fringes of, or close by, an existing village. The advantage of this practice was that Usher was able to record not only camp life, but indigenous village life and, in particular, the fascinating architecture. A men's house (*eravo*) at Parimamu village in the Vailala district (**A16**) is shown near completion; Usher's note on the back of the print explains that the completed building will extend to the front posts. Another photograph (**B88**) of an almost-completed *eravo*[3] at Vailala village shows three long and narrow, carved and painted boards hanging from the scaffolding at the front. Five similar objects were described as 'dancing shields' in an illustrated sale catalogue (No.3 of October 1895, Items 6–10) of W. D. Webster, Bicester, England. They are too long and narrow to be the sacred, named *hohao* boards normally kept in the *eravo* but could be examples of the purely decorative, unnamed boards mentioned by Newton (1961: 25) or the larger, softwood non-functional 'bullroarers' cited by Mamiya and Sumnik (1982: 12) from Williams (1936: 15; 1940: 158).

Orokolo, a coastal village situated halfway between the Vailala and Purari Rivers, was the site of a London Missionary Society station and the location of the wreck of the Burns Philp ketch 'Gira' (**A19**). Sir Douglas Mawson's father, Robert Mawson, tried for several years to set up a trading and plantation business at Orokolo before he was forced by ill health to leave in 1911. In 1955, Sir Douglas Mawson presented to the South Australian Museum three bows and 75 arrows collected by his father in the Orokolo area and two pots from the Kemp Welch River area (Hood Bay, along the coast about 100 kms south-east of Port Moresby).[4]

Orokolo was a large village and being situated on the coast was one of the ports of call for the *hiri* trading canoes from the Moresby area:

> Every year, at the end of September, or the beginning of October, the season of the south-east trade being then near its close, a fleet of large sailing canoes leaves Port Moresby and the neighbouring villages of the Motu tribe on a voyage to the deltas of the rivers of the Papuan Gulf (Barton in Seligmann 1910: 96).

The *lakatoi* (trading canoes) of the Motu would carry pots and shell wealth in exchange for sago and canoe-hulls from the tribes of the Vailala and Purari regions.

The terrain was easier on the geologists and surveyors near the coast than it was inland, although the sago swamps had their characteristic difficulties. In a testimonial that Arthur Wade wrote for Usher (dated 16 August 1914 at Port Moresby) he alludes to the type of country his surveyor had to cope with:

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[3] The men's houses among the Elema speakers, living along the coast between Orokolo to the west, through the Vailala River area as far as Sepoi (near Cape Possession) to the east, are called *eravo*. The Namau speakers of the Purari Delta, west of the Elema, call the men's house *ravi*. The word *dubu* appears to be a Motu word applied indiscriminately throughout most of the Gulf and Central Districts of Papua to refer to men's club houses and/or ceremonial platforms (see Seligman 1910: 17–22, 60–65, 141–150). Usher was not always consistent in his use of these terms.

[4] These were registered A.47390–47467 and 48080–1.

> He has a good constitution which has withstood the dangers of a trying tropical climate as well as the more trying work he has had to face in surveying lines through dense jungle [and] almost impenetrable swamp.

On one his trips into the jungle, along the He Peri track, Usher came across a fungal growth that was particularly striking. His photographs lead us to believe that it is of the species *Dictyophora*, fairly common in areas of rich soil in sheltered spots such as rainforests; its odour is memorable, being foetid as of faeces or rotten meat.

Usher's eye for ethnographic detail and for everyday activities has provided us with a record of village life at that time: a boy wearing shell wealth ornaments (**D27**); a widow with tightly bound limbs and torso (**D30**) and another painted with clay (**C83**). Other images might still be captured today: an old man staring intently at the camera cradling betel-chewing equipment in his lap (**C26**); a woman washing her baby in the sea (**C50**).

A group of women cooking sago in pots (**A44**) and the image of a man using a bow and arrow (**A50**) show interdependence within family groups: the hunters providing high-prestige food (cassowary – **B119**, cuscus – **C29**) while the women and girls process sago (**B117–118, 163**). Another image shows a boy digging out turtle eggs from the banks of the Vailala River.

But life in Papua in 1914–16 was not one of work only; the indigenous people also knew how to have fun in play. A form of 'hockey' being played on the beach at the Vailala river mouth is shown (**A56**).

Fishing provided an important component in the diet of coastal villagers. In his book 'In Primitive New Guinea' (1924: 241), Holmes records:

> surf-fishing engaged in by young and old of both sexes at Orokolo, as well as at other villages along the coast, was done with the aid of conically shaped wicker fish-traps. Periodically shoals of a sprat-like fish named *avaha* were washed into the beach; their coming was hailed with delight by everybody, and whilst they were being caught by pouncing the traps into the water, seemingly at haphazard, with the hope of encircling and entrapping a few, excitement ran very high.

According to Holmes then, the task of gathering food was in some cases a source of fun for those engaged in it. Usher took a photograph at Ipisi village near Kerema of these conical fish-traps; he records on the back of the picture that 'the boys run rapidly through the water on seeing a fish, and bring down the basket-net over it; a hole at the top enables the fish to be got out'.

Holmes also mentions in his book (ibid.) that a Y-shaped frame was used for fishing, with a net stretched between the arms of the Y. This device was submerged and the fish scooped up to fall into the slack part of the net at the junction of the fork (**B87; D26**) so that they could not escape. One photograph (**A78**) shows the Y-nets and the conical basket fish-traps being used on the same occasion.

Another method of fishing used by men and boys was with the bow and arrow and spears (**B129**). One technique was to use an uprooted sapling with its stem driven at low tide into the sand to serve as a platform. The man would stand on the sapling's roots and shoot the fish from above (**B123**).[5] The skill lay in allowing for refraction through the water. This was less of a problem for those who chose to catch fish using spears with multiple prongs at the distal end (**A110**).

Another important source of food was sago. The swamps of the Purari Delta are rich in sago palms. The starch processed from the palm pith is a good staple food and was traded with the Motuans to the east for clay cooking pots. As noted above, the task of processing sago fell to the women but the men could process it if they were on a journey and short of food.

Holmes (1924: 252) described sago-making, which explains Usher's images (**B117–118**) of the process:

> [The equipment involved a] structure of troughs placed on firmly driven cross-sticks. The troughs were the butt-ends of midribs of sago-palms. They were so arranged that the smaller and outlet end of each sloped towards the other. The top trough held the sago pith, under its outlet was placed another trough which had a much greater slope, and under its outlet was the last trough, which rested, at its lower end, on a slightly tilted receptacle which had been made from the supple part of the spathe of a bastard palm. The smaller and outlet end of each trough was covered with gauze-like fibre obtained from coco-nut trees. This fibre acted as a sieve to prevent stray bits of pith from reaching the receptacle on the ground. The sago globules were extracted from the pith by the woman thrashing it with a long stick and by her frequently washing it

[5] This became a popular image of the Papuan fisherman early in the century (e.g. Holmes 1924, bookcover).

with water intermittently. The water carried the released sago with it through the sieves to the receptacle on the ground, where the latter remained as residuum, whilst the former slowly dribbled away as an overflow. The woman occasionally poured off the water, with her hands scooped up the sediment, put it into a plaited grass bag, suspended it to a branch of a tree, where, what water was still left in it could continue to drip away until only good edible sago remained.

The oil fields operation employed Papuan labourers, not only from the areas in which the oil exploration was being conducted but also from other administrative divisions, and these labourers brought their own tribal skills and traditions with them. The bridge built by Mambare men at Vivirai is but one example. A portrait of Bangoda, decorated as a Mambare warrior with face paint, a tiara of hornbill beaks ('signifying he has killed his man') and feather headdress, shows one of the bridge-builders dressed up for a sing-sing.

With the growing influence of missionaries of various nationalities and religious persuasions, traditional forms of clothing were supplanted by items of western dress. Usher encountered these people at a time when these changes were just beginning to have their effect on the Papuan way of life. One of the strengths of Usher's photographic work is his study of groups of people in traditional attire. These groups include families, boys, girls, men and boys together, women and babies, women and girls together, women involved in food preparation. Many of these groups are deliberately posed for the camera but are important studies of dress and adornment in a culture much changed.

A21 shows a family group at the village of Orokolo, sitting on the steps of the family home. Note the crescent-shaped pearl shell ornaments around the necks of both adults and children. The *kina* (pearl shell) seen in the Papuan Gulf region comes from either east of Port Moresby via the *hiri* trade, or from Torres Strait via the western Gulf trade links. In the Highland Provinces where these shells are scarce they take on greater value. In 1975, the newly independent nation of Papua New Guinea took the name of this shell currency as its major monetary unit, corresponding to the Australian dollar.

Usher also recorded ceremonial activities, important episodes in the rites of passage from childhood to adulthood. **B86** shows a boy who is going through the '*dubu*' (*eravo* - men's house) ceremony in Vailala village. If it was necessary for any of the initiands to leave the *eravo* and pass through the village, they had to be covered, i.e. their identities hidden, by wearing a *hara*, a cloak woven from the frond of a coconut (or perhaps sago) palm which concealed them from view.

An important Purari Delta ritual object was the roughly-woven cane 'monster' called *kaiaimunu* (**D28**) which 'devoured' the initiands during their seclusion in the *ravi* (men's house). The boys emerged from the *ravi* reborn, with glistening skin, bright shell and feather ornaments, and fore-and-aft '*ramis*' (Motu word for loin cloth) of bark cloth painted with rectilinear designs (**D21**), young men, as Usher noted on the back of the photograph, 'now eligible to marry'.

Usher did not have the good luck to witness the dancing of the Purari *aiaimunu* (or *hevehe* as they were known at Orokolo,[6] and *semese* at Vailala). These spectacular oval masks could be up to 8 metres tall. They were constructed by stretching bark cloth over a cane framework and marking out coloured designs by sewing on slender strips of cane. The South Australian Museum has one *aiaimunu* 2.8 metres high (**A.8554**) and another 1.2 metres high (**A.7422**), both probably from the inland Namau of the Purari Delta, obtained in the late 19th century; there are also two *kanipu* (**A.7420,–1**), much smaller versions of *aiaimunu*, from the same area.

Despite missing out on the performance of *aiaimunu*, Usher photographed a few tied to the front of dwelling houses at Maipua (**D2**) and inside a *ravi* (**D8**). These were of the coastal and inland Namau type respectively. During his survey along the coast from Vailala to Moresby, he also came across four men wearing a different type of mask at Koraita near Kerema (**B127**).

The interior of the *ravi* is shown in several photographs: **C81** at Iai (Iari) in the Purari Delta shows several carved and painted ancestral boards (*kwoi*)[7] in association with displays of human skulls; **D6** and **D17** (prints incorrectly number

[6] The South Australian Museum has 27 glass plate negatives and one nitrate negative of photographs taken by F. E. Williams in Orokolo, mostly during his fieldwork in 1931–2. All were published in his book 'Drama of Orokolo' (1940) and for the most part concern the construction, dancing and destruction of the *hevehe* masks. These negatives are archived under the name of F. R. Vyse, Accession No.335.

[7] Called *gope* to the west of the Purari and *hohao* among the Elema to the east.

D17 and D6 respectively, by Usher) show several *kwoi* in association with pig and crocodile skulls on either side of the central passage of a *ravi* at Kairu; **D8**, taken in a *ravi* at Koropenaira, shows several *kwoi* and *aiaimunu*, a small mask called *kanipu* and, half hidden behind three handdrums, a carved and painted rectangular board that appears to be a shield remarkably like those to be found among the Fegolmin and Angkeiakmin of the Fly River headwaters in central New Guinea (cf. Craig 1988, fig.40). The *kwoi* bear carved and painted anthropomorphic, and sometimes zoomorphic, designs on wood recycled from old and broken canoes. The South Australian Museum has seven old ancestral boards (**A.7678–7684**) which from their designs appear to come from Orokolo or another nearby village in the lower Vailala River area (cf. Newton 1961, Figs 34, 43, 243–8). F. E. Williams, Papuan Government Anthropologist, described these boards (called *hohao* among the Western Elema of Orokolo where he did his fieldwork) as follows (1940: 154):

> The carving, deeply incised, depicts a highly conventionalized human face with forehead, eyes, nose, and mouth, together with a number of decorative additions. It is grotesque in the extreme, but not without its effectiveness in the total surroundings. In some rare cases a whole human figure is displayed; and in some others the flat board has developed into a figure carved in the round and bearing on the crown of its head a tousled mop of human hair.

The South Australian Museum has one such figure (**A.72748** – 1.43 metres high), male, but without the hair; it appears to be from Orokolo (cf. Newton 1961, Figs 249, 250). Another male figure (**A.33410** – 1.6 metres high) with hair attached, in an assymetric 'dancing' pose determined by the shape of the wood from which it was carved, is more likely from a coastal Namau village (cf. Newton 1961, Figs 212, 213) although it came to the Museum without provenance.

The inside of the men's house was divided into areas known as *larava*. Each clan in the tribe had its designated *larava*, and the clan *kwoi* or *hohao* boards were displayed in their particular areas. There were also small oval plaques of palm bark, carved and painted with face designs, attached to the men's house posts (see **D6**, taken at Kairu, inland Namau); the South Australian Museum has two of these (**A.7419, 7445** – cf. Newton 1961, Fig.231) which appear to come from the inland Namau. Two similar pieces (**A.7417, 7418**) but differing in being cut with leg-like forms at the bottom, are possibly canoe prow 'shields', not men's house post plaques.

The *larava* is where the men traditionally sat and talked. The *kwoi* or *hohao* were displayed in these areas unless the space was required for the giant *aiaimunu/hevehe/semese* masks, at which time the boards were placed in the dark and dusty recesses at the rear of the men's house amongst the rubbish. However, this does not mean that the boards were not revered; they were. Indeed, they had personal names and were of great significance, representing bush spirits associated with clan ancestors. Williams records (1940: 156) that an incident on a hunting trip could be followed by a dream in which a spirit instructs the man to carve a board to mark the occasion. This secret story of the *hohao* would be passed on from father to son, the board being kept in the *eravo* for many years. Two *kwoi* in Usher's photo **D6**, taken in a *ravi* at Kairu around Christmas 1915, are the same as two *kwoi* previously photographed by A. B. Lewis in May 1912 in the same *ravi* (Newton 1961, Figs 33, 218).[8] The differences in the *kwoi* displays over a short period of only 3½ years indicates something of the constantly changing nature of the *ravi*'s interior furnishings.

While creating a database for Usher's collection of J. W. Beattie postcards, the number of scenes which included canoes made it necessary to find out more about the various types. The standard work on canoes of Oceania, that by A. C. Haddon and J. Hornell, proved invaluable. A wealth of data can be found in or through that reference which explains several of Usher's images.

The largest canoe constructed by the Papuans was the multi-hulled *lakatoi* used in the *hiri*, the annual trading voyages by the Motu of the Moresby area in the east to the Elema and the Namau of the Vailala and the Purari Rivers in the

[8] cf. Newton 1961, plates 33, 218, which are reproductions of photographs taken by A. B. Lewis in 1912 for the Field Museum in Chicago, two years before Usher arrived. The *kwoi* to the left of the passageway in the first *larava* in Usher's photograph is in a corresponding position in Newton 1961, plate 33; the *kwoi* to the left of the passageway in the second *larava* in Usher's photograph is in a corresponding position in Newton 1961, plate 218.

west. The Motu took pots[9] and shell ornaments[10] and exchanged them for canoe hulls (*asi*) and sago, neither of which could be found locally. The *lakatoi* sailed to the Gulf villages as three- or four-hulled vessels and returned as reconstructed vessels with many more hulls.

Haddon and Hornell (1975: 227) report that the term *lakatoi* is derived from *laka* (Motu form of *wa, waka, waga* – a canoe with strakes), and *toi* (Motu form of *tolu* – three). Illustrations of *lakatoi* were most popular in books that dealt with this part of Papua and most visitors with cameras endeavoured to secure photographs of them.

Haddon and Hornell (op cit.) quote from Barton's account of the *hiri* included by Seligman in his book (1910: 96–120):

> A *lakatoi* is composed of three or more *asi* [dugouts], which are made of a soft-wood tree (*ilimo*) of great size that grows close by rivers in their low alluvial reaches in the Papuan Gulf district. The Gulf natives fell the trees and float them to the *lakatoi* that have arrived on a trading expedition (*hiri*). The trunks are hauled on to the bank of the river, where the visitors hollow them out and shape them. Fire is not employed in this operation. An *asi* is a clumsy dugout with rounded or squared ends prolonged above into a projecting flat beak. An unusually large one measured in 1886 had a length of 47 feet 8 inches from the tip of one beak to that of the other . . .
>
> The *asi* are secured together by numerous cross beams which are tied by lashings that pass through square holes cut in their gunwales. Over these beams a large platform or deck (*ilaha*) is constructed; this must be made very strong as it has to stand the strain of the great waves of the Gulf. The platform extends beyond the *asi* especially fore and aft. In 1884 the largest *lakatoi* which arrived at Port Moresby from the Gulf consisted of 14 *asi* and measured 59 by 51 feet; two smaller ones measured 54 by 37 feet.

Usher recorded four views of *lakatoi*. The first is of the central open deck space bounded by the large four-sided shelter that has been constructed on the multi-hulled vessel. The next image shows a fully-rigged *lakatoi* moored off the village of Kaimare in the Purari Delta (**C93**). The last two images (e.g. **C100**) are of a nine- or ten-hulled *lakatoi* moored beside Ukiaravi village in the Purari Delta, waiting for its load of sago to be brought in exchange for the pots and shell ornaments it has delivered. Barton gives a clear idea of the volume of trade involved (Seligman 1910: 114–5):

> The average number of men who go in a *lakatoi* is 29. In 1885 four *lakatoi* left Port Moresby each carrying an average number of 1628 pots. In 1903 the Kwaradubuna . . . equipped a *lakatoi* . . . consisting of 4 *asi*. The total number of pots carried in this *lakatoi* was 1294, giving an average therefore of 324 pots per *asi*. Assuming that 20 *lakatoi* sailed that year, and that each was composed of 4 *asi*, the total number of pots taken was 25,920. In addition to the pots the Kwaradubuna *lakatoi* took in that year 57 *toia*, 2 *mairi*, and 8 *tautau*, besides a certain quantity of trade tobacco and other imported articles. This vessel on her return voyage consisted of 10 *asi*, and her cargo of sago would therefore have been about 25 tons. Dr Lawson informed me that in 1884 the largest *lakatoi* consisting of 14 *asi* returned with 34 tons, and two others with 30 tons each.

The canoes of the Papuan Gulf were generally plain and practical although some of the larger dugouts had a panel of carved and painted designs along each side (**C91**). A single dugout for use in river travel was paddled along by people who stood in the canoe. For transport along the coast, outrigger canoes were used because they gave greater stability in the winds and strong currents found in the Gulf.

Apart from his interest in the indigenous inhabitants, Usher also noted the European presence on the outstations in the Gulf region (e.g. **C51–2**), in Port Moresby (especially a magnificent 6-frame panorama of the town) and at Herbertshöhe and Rabaul (e.g. **E33**). Other photographs record the visit to Port Moresby of the Admiral of the Fleet, Sir George E. Patey, K.C.M.G., K.C.V.O., R.N., Commander in Chief, Royal Australian Fleet, 1913/15. The visit was in August 1914, at the outbreak of the First World War. The people from the vicinity of Port Moresby put on a display of dancing to mark the occasion (**A146–7**).

The photograph **A147** (neg. A154) is an interesting study of the appropriation of a European artefact for an otherwise indigenous work. A close look at the headdress of the dancer on the right reveals the incorporation of a pack of

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[9] There were seven types of Motu pots (Barton in Seligman 1910: 114, fn.2).

[10] There were three main types of shell wealth: *toia* (shell armlets), *mairi* (pearl shells, whole or crescent-shaped), and *tautau* (nassa or 'dog-whelk' necklaces). A large *toia* bought a 250 to 350lb package of sago or one *asi* (canoe hull); a large *uro* pot bought a bag of about 80lbs of sago and a small *uro* pot or a *keikei* pot bought about 40lbs of sago (Barton in Seligman 1910: 115).

playing cards. Western icons became commonplace in tribal life over ensuing years and the nature of New Guinea art changed accordingly. The introduction of new objects and designs into a tribal society can be both challenging to tradition and a means of widening the horizons of the recipients.

> No matter how strong their traditions or how firm their faith in their own intrinsic worth, the people are now exposed and vulnerable and they must enter a new age if they are to survive into the future (Blackburn 1979: 15).

This meeting of two cultures should not necessarily be seen as negative although the asymmetry of power relations between colonisers and colonised meant that most of the change was carried by the colonised. It is safe to assume, however, that when the dancer in Usher's photograph conceived of the playing cards as components for his headdress, he didn't see the death of tradition but rather an opportunity to impress his audience with something novel.

Usher On Leave

Apparently, on his way home on leave some time in the first half of 1916, Usher (**E47**) travelled aboard the cargo boat 'Meklong' from Moresby to Herbertshöhe and Rabaul via Samarai, then called at Morobe and various other ports on New Britain, then on to the Shortlands off the southern end of Bougainville, and through the Solomons, presumably then on to Australia.

> The 'Meklong' was a cargo steamer with a carrying capacity of about 175 tons. Her hull was of iron, and she was capable of steaming seven knots in smooth water: if any sea was running, her speed became uncertain. Owned by the Norddeutscher-Lloyd, she had formerly been used for bringing rice down the Siamese river from which she took her name. In New Guinea she had been employed in collecting cargo from out-lying islands for transhipment at Rabaul to the Norddeutscher-Lloyd steamers, which connected the colony with the East and with Europe. Since her capture [in 1914 by HMAS 'Parramatta'] she had, after various naval and military services, been put back into the cargo trade, and Brig-Gen. Sir Samuel Pethebridge proposed to use her for the despatch of supplies to the islands, and for the concentration of copra at Rabaul for transhipment to Sydney. With her shallow draught, her small consumption of coal, and her comparatively large carrying capacity, the 'Meklong' proved a most servicable vessel in the work of the administration (Mackenzie 1938: 200–201).

It was probably this excursion that sparked Usher's interest in obtaining postcard photographs of these areas. Although Usher's trip through the Solomon Islands was fleeting, his photographs and his collection of Beattie postcards give us a record of life and culture in the islands around 1916. Among the images is a picture of two 'War' canoes that were kept in a canoe house on Vella Lavella (**F3**). These canoes are of the *mon* type, without an outrigger. Haddon and Hornell (1975: 108–9) have a description of an identical canoe housed in the British Museum that came from the the same island:

> Both ends are alike and rise into a high peak which is ornamented with *ovulum* shells along its outer edge and along the inner edge with triangular toothed pieces of shell. The sides are decorated with inlay. A bunch of feathers is on the tip of each peak.

Haddon reports (ibid.) that Carl Ribbe, in his book 'Zwei Jahre unter den Kannibalen der Salomo-Inseln' (1903), mentions that the *mon* canoes of Vella Lavella have two human heads facing fore and aft on the peaks of the canoe prows. This appears to be a visual reference to the headhunting activities of the owners of the canoe. Unfortunately the South Australian Museum's example (**A.8059**), obtained from Tost and Rohu in Sydney late last century, has lost the high peaks, ornamented with the *ovulum* shells, at each end.

Usher's Death

Ernest Sterne Usher died in Papua on 23 September 1916, not long after his return from leave. The following article appeared in *The Papuan Times* on 4 October 1916:

> BOATING FATALITY
>
> News has been received of the death by drowning of Mr A. [sic] Usher, surveyor to the oilfields. This gentleman has been engaged in cutting a new road at the back of Orokolo to a new bore site. Mr Usher was drowned whilst crossing the Vailala river from the western side at its mouth. There was a fresh[11] in

[11] 'Fresh': a sudden rise in water level caused by overnight rain upstream. Tidal bores also are a dangerous phenomenon in rivers draining south into the Gulf of Papua. It was a tidal bore that swept Michael Rockefeller and his companions out to sea during his work among the Asmat of Irian Jaya; presumably he drowned when he attempted to swim back to shore.

the river at the time, resulting in a very strong current. The deceased attempted to cross in a small canoe with three boys. He was warned by the Village Constable to obtain a larger canoe, but replied that a smaller one would be quicker. The canoe was swamped, and the current swept the unfortunate man out to sea. He endeavoured to swim ashore, but became exhausted and sank. His body has not been recovered so far. Two natives reached the shore in an exhausted condition, but the third boy was drowned, and his body washed ashore two days later.

Mr Usher was extremely popular on the oilfield, and only returned to the oilfields three months ago after a holiday south. The sad news of his death caused a feeling of depression on the field, where his many friends heard the news with the greatest regret.

Discussion

Research on the Usher collection continues. Although most of the photographs have something written on the back and there is a short description of each photograph in a list for each of the alphabetic series, we do not know what became of his field diaries which he would have kept to document his survey observations. They were probably taken over by Wade but we have yet to locate Wade's diaries and records. The present numbered sequence of the photographs is not always consistent with the few facts we do know of Usher's itinerary. It is possible that we could get a clearer idea of the sequence of the photographs from Usher's field diary, even if he did not record each day exactly when and where he took each photograph.

Nevertheless there is sufficient data in the images to throw light on the nature and significance of undocumented or incorrectly described ethnographic objects held by museums (as noted above for the long narrow carved boards in the Webster catalogue), and to conduct a comparative study of ethnographic material over space (that is, comparing the material culture of people in several neighbouring communities) and over time (by looking for images from a number of photographers showing the same place at different points in time). The comparison of Usher's **D6** with certain photographs by Lewis 3½ years earlier has identified two *kwoi* apparently in the same men's house but in association with different *kwoi* on each occasion. Usher's photographs taken at Kaimari in 1915 (C93, 97,98) may be compared to Hurley and Williams photographs taken at Kaimari seven years later.[12] Thus there is much scope for comparing the photographs of Lewis, Usher, Chinnery, Hurley, Wirz, Williams, and perhaps others not yet identified, to elicit information on continuity and change in the cultures of the region.

The Usher collection is one man's window on cultures that have existed for hundreds if not thousands of years, cultures that have not been static but responsive to changes in the environment, to impacts from outside and to impulses from within. We do not know exactly why Usher set about making such a thorough photographic record. Was it simply curiosity? Was it a way of letting his family know what he was doing? Did he have some grander purpose? These photographs join other major collections of photographs of the colonial era that provide the data for analysis of the way Europeans have viewed tribal peoples in the Pacific (and indeed elsewhere in the world). This paper has not attempted such an analysis but the brief notes attached to Usher's images do suggest to the authors that his attitude towards the indigenous people was positive and his aim consistent with an ethnographic purpose of recording the lifeways of people still living more-or-less as their ancestors lived before Europeans came to work among them. This record will undoubtedly be of considerable interest to the descendants of those people and it is intended to explore means for making the photographs accessible to them.

[12] E.g. Hurley: V.4867, V.4873 in Specht and Fields 1984: 167, 169; Williams: Australian Archives A6003/37.3.

Index To Usher Photo Albums A To F

ALBUM A	LOCATION	USHER'S DESCRIPTION	INDEXER'S NOTES
A1–4a,b	Melbourne, VIC.?	[Family photos; Melbourne?]; June 1916	Negatives only
A5	Upoia, Vailala River	White quarters	
A6	Upoia	Weekly muster of labourers	
A7	Upoia	Inspection of police and rifles	
A8	Upoia	Looking upstream at camp and Vailala River	
A9	Upoia	Boys houses at Upoia	
A10	Upoia	Main camp; view from west side	Destroyed
A11	Upoia	Setting off from Upoia to Aro Aro January 1914	
A12	Parimanurri, Vailala District	Crane and Wrathall paying women carriers.	Mr W.J. Crane was Patrol Officer from 6-7-14 to 3-3-15
A13	Parimanurri	Village scene	
A14	Parimanurri	Camp at Parimanurri	Destroyed
A15	Parimanurri	Survey camp	
A16	Parimanurri	Dubu at Parimanurri; the completed building will extend to the front posts.	
A17	Orokolo, Vailala District	Typical dubu at Orokolo Village	
A18	Orokolo	Traders house (Mr McDonald's) at Orokolo	
A19	Orokolo	Sunday School at London Missionary Society Mission, Orokolo (Tongan missionary), showing wreck of Burns Philp ketch 'Gira', with Crane, McDonnell and Wrathall on deck	
A20	Orokolo	Village scene	
A21	Orokolo	Family group	
A22	Orokolo	Village scene	
A23, 24	Ferntree Gully, VIC.	[Family photos, Ferntree Gully picnic]	Negatives only
A25	near Muru village	Bush track scene	
A26, 27	Muru village	Group on dubu; family group	Destroyed; replaced with negatives of family photos, Ferntree Gully picnic, Victoria
A28	Muru village	Man climbing coconut tree . . . notice breadfruit trees and method of marking coconut tree for ownership	
A29	Muru village	Well-constructed typical dubu	Destroyed (but see A48)—replaced with negative of family photo of Joan
A30	Heperi Camp	White bell-shaped fungus	
A31	Ravi Ravau village, Purari Delta	Village scene with canoes—all paddling is done standing up.	
A32, 33	Ravi Ravau village, Purari Delta	Village scene with canoes	
A34	Aiari village, Purari Delta	Interior of dubu	Destroyed—replaced with negative of family photo of Joan, Marion and Edith
A35	Maipua village, Purari Delta	Panorama taken from rocking canoe	Destroyed—replaced with negative of family photo of Joan
A36	Vivirai, Vailala River	Bridge built by Mambare Boys at McDonald's	'Boys' = men
A37	Vivirai camp	Bridge built by Mambare Boys, Vaivira camp (McDonald's)	'Boys' = men
A38	Vivirai camp	River Scene looking up Vailala River from McDonald's (Vaivira)	On negative, says 'Maira, V.O.'

A39–41	Maira camp	Views from Maira Camp and among sago palms along Maira track	Destroyed—replaced with negatives of family photos of Joan
A42	Vailala village	Group of boys	
A43	Vailala village	Group of girls; notice method of shaving head	
A44	Vailala village	Women preparing for a banquet—note village dogs and cooking pots	
A45	Vailala village	Preparing banquet	
A46	Vailala village	Cooking scene	
A47	Vailala village	Big dubu	Destroyed
A48	Idikaku village, Vailala River	Well constructed typical dubu, near Lett's	
A49	Idikaku village	Group of men and boys	
A50	Idikaku village	Man firing bow and arrow; near Lett's	
A51	near Mairu, Vailala River	Forest track scene between Lett's and Maira	
A52	Vailala River	Shifting camp by whale boat, Lett's.	Destroyed
A53	Vailala River mouth	Mid-day meal at Rest House; C. Henry (P.O.) standing; L. L. Wrathall and E. R. Stanley sitting; cook boys Heraciou and Toi.	
A54	Vailala beach	Fishing boys	Destroyed—replaced with negative of family photo of Marion and Joan
A55	Vailala?	My survey boys—left to right, Kao-I, Kebe, Ikavu, Obovda, Bets	Destroyed—replaced with negative of family photo of Joan
A56	Vailala River mouth	Hockey on the beach —photo taken at nearly sunset	'boys' = men
A57	Vailala River mouth	Towing the stranded 'Orokolo' through the surf to the Vailala mouth; notice three tow lines and boys keeping boat in deep water	
A58	Vailala Beach	Group of boys and girls; 'Orokolo' ketch in background being dragged along by natives	
A59	Vailala River mouth	Towing the ketch 'Orokolo' into the river	'boy' = man
A60, 61		Mambare 'boy' (Bangoda) in dancing costume – notice bills of Hornbills signifying that he has killed his man	
A62	Koraita village, near Kerema	Woman and very young child	
A63, 64	Koraita village	Family groups	Destroyed
A65	Ipisi village, near Kerema	Children	
A66, 67	Kerema	Woman and child; women on canoe	Destroyed
A68	Ipisi village	Fishing boys; the boys run rapidly through the water on seeing a fish and bring down the basket over it—a hole at the top enables the fish to be got out.	
A69	Koraita village	Women and children digging in the sand for Lingulae (very ancient form of brachiopod)	
A70	Kerema	Mambare boys dancing	'boys' = men
A71	Kerema	Mambare boys ready to dance	'boys' = men
A72	Kerema	Mambare boys ready to dance	Destroyed
A73	Ipisi village	Woman carrying firewood and baby	
A74, 75	Kerema	Groups [of people]	Destroyed
A76	Kerema	Large group of fishing people after a shoal of fish	
A77	Kerema	Group of fishermen	
A78	Kerema	Fishing boys	
A79	Kerema	Women carrying evening meal (sago and potatoes)	in pots
A80	Koraita village	Women returning with a load of shrimps	in canoe
A81, 82	Kerema	Group of police with Magistrate (Mr J. F. Keeland)	
A83	Koraita	Women cooking shrimps in leaves—smoke in centre of picture	

A84	Kerema	Police sergeant and wife at Kerema government station	
A85	Selon [?] village	Group [of people]	Destroyed
A86	Kukipi	Loading canoes at Kukipi for transport	
A87	Motu Motu	Motu Motu boys interested in a theodolite	
A88	Motu Motu	Group of girls making ramis	
A89	Motu Motu	Women stripping leaves from a sago palm for making grass skirts [ramis]; notice heads of all showing various styles of cutting hair	
A90	Lese village	Lese Village	Negative missing
A91	Lese village	Transport by canoes (Max Aspin's store); my survey boys (Mambares) in front with theodolite and other equipment	
A92	Mairu village	Women and babies	
A93	Mairu village	Fishing boys using bows and arrows at Mairu village	
A94	Lese village	Widow at Lese village	
A95	Lese village	Woman and child at Lese village	
A96	Lese village	Man and child	Destroyed
A97	Moru village	General view	Negative missing
A98	Moru village	Baby	
A99	Moru village	Cooking scene	
A100	Moru village	Picanninny [sic]	
A101	Moru village	Widows and children	
A102	Moru village	Village scene	
A103	Sepoi village	Village scene	
A104	Sepoi village	Group of women	Negative missing
A105	?	?	Destroyed
A106	Sepoi village	Samoan missionary's house	
A107	Sepoi village	Mission children	
A108	Kivori village, near Cape Possession	General scene; note: wind screens, fenced houses which are right on the ground	
A109	Kivori village	Group of well tattooed women	Tattoo markings do not show well
A110	Sepoi village	Men spearing fish	
A111	Sepoi village	Group of natives on the beach	
A112	Mairu village	Youthful couple	Toddlers
A113	Mairu village	Preparing for a feast	
A114	Mairu village	Group of men	
A115	Berena village	Native graveyard at Berena Village, west of Yule Island; the roofs over the graves vary from 5ft to 7ft high	Negative missing
A116	Kerema	Portrait of C. Henry, Ass. Resident Magistrate, Kerema	Destroyed (but see A130)
A117	Berena village	Picanninny	
A118	Berena village	General scene	
A119	Berena village	Dubu, houses, and baggage	
A120	Berena village	Washing baby who is vigorously protesting; note deep tattooing on the women	Tattoo markings do not show well
A121	Kivori village	Group of tattooed women	Tattoo markings do not show well
A122	Maiva village	House with garden	
A123	Kivori village	Back view of tattooed women	Tattoo markings do not show well
A124	Maiva village	Well kept native house	
A125	?	Young boys spearing and rolling coconuts at village; one boy stands at the side and rolls the coconut rapidly along the ground—they are remarkably good shots	

A126	near Berena village,	Mid-day halt with carriers	
A127	Mohu (Mou) village, near Yule Island		General view
A128	Mohu (Mou) village	Typical dubu	
A129	Mohu (Mou) village	Group of men and women (carriers) . . . C. Henry in front	
A130	Kerema	Portrait: C. H. Henry	Arrived 14th July 1914 as Assistant Resident Magistrate, Gulf Division
A131	Pinnapaku	Well decorated, tattooed women from Mou village	Tattoo markings do not show well
A132	Yule Island	Picanninny at village about 1.5 miles from Yule Island Mission Station	
A133	Yule Island	Group of young children at Yule Island Village	
A134	Yule Island	(Men) Boys building a house at Yule Island Village	
A135	Yule Island	Typical Dubu at Yule Island village	
A136	Yule Island	General view of Yule Island Mission Station (R. C. Sacred Heart Mission)	
A137	Yule Island	General view of Yule Island looking from flagstaff of Government Station towards Mission Station – Ketch 'Sir Arthur' in foreground	
A138–142	Port Moresby	Panorama of Port Moresby looking from Mr Staniforth-Smith's home towards land office [then 180° to right over the town to Ela Beach and coastline beyond]	Negative sequence 139, 140, 143, 142, 144
A143, 144	Port Moresby	Panorama of Port Moresby looking from behind Hospital towards Paga Hill [left to right]	Another list says 'from behind Government Secretary's Office'; negative sequence 141, 138
A145–169	Port Moresby	Dancers at Police Barracks, Port Moresby, in honour of the first visit of the Admiral of the Australian Fleet, July 1914	Negative sequence: 151, 168, 154, 148, 159, 158, 157, 156, 155, 152, 153, 149, 145, 147, 163, 165, 160, 162, 161, 164, 146; negatives of 159, 160, 168 missing, and print and negative of 164 destroyed
A170–173	Port Moresby	[Left to right] Panorama of Elevara, Hanuabada and Comdobu [Konedobu?] at Port Moresby	NB. London Missionary Society Church in 172; negative for 173 missing
A174–176	Port Moresby	As above	Destroyed
A177	Near Port Moresby	Group of natives at village near Port Moresby	
A178	Near Port Moresby	General view of village near Port Moresby	Negative A185
A179	Near Port Moresby	Father and son, Hanuabada	
A180	Near Port Moresby	Natives, village near Port Moresby	Negative missing
A181, 182	?	Woman and baby	Destroyed
A183	Port Moresby	Woman and child, Hanuabada	
A184	Port Moresby	Portrait : J. W. Murray	Negative missing
A185	Port Moresby	General view—village near Port Moresby	Negative A178
A186	Hanuabada	Picanninny [sic]	Destroyed

A187	Heperi village, Vailala	E. S. Usher on dubu at Heperi village	Negative missing
A188	Port Moresby	H.M.S. 'Encounter' showing view of Fairfax Harbour	Negative A189
A189	Port Moresby	H.M.S. 'Encounter' entering Port Moresby Harbour on the occasion of the first visit of the Admiral to Papua, July 1914	Negative A190
A190	Port Moresby	View of Port Moresby Harbour looking towards Titava Island	Negative A188
A191	Port Moresby	Wharf, Port Moresby, decorated for visit of Admiral of the Fleet	
A192	Port Moresby	Port Moresby—Papua	Burns Philp store with tower, at right
A193	Port Moresby	General scene—Hanuabada, Port Moresby	
A194	Port Moresby	Portrait: E. S. Usher	Destroyed
A195	Port Moresby	Portrait: L .L. Wrathall	
A196	Port Moresby	Portrait: Dr Arthur Wade	
A197	Port Moresby	Portrait: Evan Richard Stanley	
A198	Port Moresby	Portrait: J. W. Murray	
A199	Port Moresby	Portrait: E. S. Usher	
A200	Port Moresby Papua	Group photo of Wade Oil Expedition members, Rear: Wrathall (left), Murray (right); middle, left: Usher; front: Stanley (left), Wade (right)	

ALBUM B	LOCATION	USHER'S DESCRIPTION	INDEXER'S NOTES
B1, 2	Port Moresby	S.S. 'Kanowna' Troopship coming into Port Moresby—outbreak of War, August 1914	
B3, 4	Port Moresby	Troops on S.S. 'Kanowna'	
B5, 6	Port Moresby	Torpedo destroyers alongside 'Kanowna'	Destroyed
B7	Port Moresby	Australian Troops drilling at Port Moresby (in groups across the landscape)	
B8	Port Moresby	Australian troops at Port Moresby; left of centre: others in groups under trees	
B9–12	Port Moresby	Australian troops drilling at Port Moresby at the outbreak of War	
B13, 14	Port Moresby	Heliographers at work	
B15	Port Moresby	Red Cross Corps—Port Moresby	
B16–18	Port Moresby	Torpedo destroyers at Port Moresby	Destroyed
B19	Yule Island	Canoe scene—Yule Island	
B20	Yule Island	Canoe scene—Yulé Island	
B21	Yule Island	View of Roman Catholic Sacred Heart Mission Station taken from the sea at Yule Island	Negative missing
B22, 23	Aidana village	Scene at Aidana village near Port Moresby – panorama [right to left]	'Quarabada' on negatives and list
B24	Aidana village	Group of young children at Aidana village	
B25	Aidana village	Group of young boys at Aidana village	
B26	Port Moresby	Church of England—Port Moresby, August 1914	
B27–29	Port Moresby	Start of first railway in Papua—Port Moresby, August 1914	
B30	Port Moresby	Coast scene near Koki	Destroyed
B31	Upoia?	View from house looking towards river, Feb. 1915	Destroyed
B32	Upoia	New house, Feb. 1915	Destroyed
B33	Kerema?	Mr Massey-Baker in canoe, Feb. 1915	Destroyed
B34	Kerema	Government station , Kerema, Feb. 1915	Destroyed
B35	Ipisi village near Kerema	Baby, Feb. 1915	Destroyed
B36	Ipisi village	Boys playing in surf, Feb. 1915	Destroyed
B37	?	Cutter Nouei [?] from 'Ela', Feb. 1915	Destroyed
B38	Vailala River mouth	Natives dressing to go home, August 1914	
B39	Vailala River mouth	Natives transferring goods to canoes from launch, August 1914	

B40	Vailala River mouth	Off for home in canoes, August 1914	
B41	Vailala River mouth	Canoes coming out to meet boat, August 1914	
B42	Upoia	Launch 'Ela', August 1914	
B43	Koraita near Kerema	Canoe building, August 1914	
B44	Koraita	House (dubu) in building, August 1914	
B45	Upoia	Unloading cargo at Upoia, Vailala Oilfields	
B46	Upoia	Distributing weekly allowance of tobacco, matches etc.	
B47	Near Port Moresby	Woman and child—village near Port Moresby	
B48	Near Port Moresby	Old couple—village near Port Moresby	
B49	Near Port Moresby	General view—village near Port Moresby	
B50	Near Port Moresby	Street scene—village near Port Moresby	
B51	Near Port Moresby	View to coast from village near Port Moresby	Destroyed
B52	Near Port Moresby	Village scene near Port Moresby	
B53	Upoia	Large rubber tree showing aerial roots—Upoia	
B54	Upoia	Boys road making at Upoia	
B55, 56	Upoia	Transporting boring plant—Upoia, Sept. 1914	
B57	Upoia	Boys going to work—Upoia, Sept. 1914	
B58	Upoia	View from bore site No.6 to white quarters, Sept. 1914	Destroyed
B59	Upoia	View from bore site No.6 to white quarters, Sept. 1914	
B60	Upoia	View from white quarters to river, Sept. 1914	Destroyed
B61	Upoia	View from white quarters to river, Sept. 1914	Negative missing
B62, 63	Upoia	View from white quarters to river, Sept. 1914	Destroyed
B64	Purari village, Vailala River	Two old women	
B65	Purari village	Native house and group	
B66	Purari village	Group of women	
B67	Purari village	Group of men	
B68	?	A mid-day halt on Purari trip—J. W. Murray on whaleboat	
B69	Vailala River	View of Vailala River from white quarters looking south	
B70, 71	Akauda village, Vailala River	Group of women	
B72, 73	Hahia village	View from Hahia village looking towards Upoia	Destroyed
B74	Upoia?	Group taken at departure of Mr C. H. Locke	Destroyed
B75	Urawoi village	Group of men and carriers, Oct. 1914	
B76	Urawoi village	Group of women, Oct. 1914	
B77	Borki village, Vailala River	Group of old men, Oct. 1914	
B78	Borki village, Vailala River	Group of children, Oct. 1914	
B79	Urawoi village district	Fish traps across creek, Oct. 1914	
B80	Urawoi village district	Large rubber tree with aerial roots, Oct. 1914	
B81–83	Between Upoia and Borki	Rock exposures between Upoia and Borki, Oct. 1914	
B84	Between Upoia and Borki	Survey group on Stadia Traverse of Vailala River, Oct. 1914	
B85	Upoia	Smiths (Dullers') house, Oct. 1914	
B86	Vailala	Boy who is going through dubu ceremony, Oct. 1914	Negative missing
B87	Vailala village	Fishing women, Oct. 1914	
B88	Vailala village	Dubu under construction, Oct. 1914	
B89	Vailala village	Group of young children, Oct. 1914	
B90	Vailala River	Hunting for turtles eggs, Oct. 1914	
B91	?	Kiwi boys shaving with broken glass, Oct. 1914	
B92, 93	Upoia	Group of white residents Upoia	
B94	Vailala village	Woman with elephantiasis	Destroyed
B95	Upoia	Portrait of J. Hodges	Destroyed
B96	Vailala village	Women cutting hair	Destroyed

B97	?	Nobigu, my cook boy	Negative only
B98	Ivori River	Murray Falls on Ivori River (Mr Massey-Baker, R. M.), Nov. 1914	
B99	Hukerara village, Vailala River	Tree house, Nov. 1914	
B100	Vailala River	Canoe scene, Vailala River near Ivori River, Nov. 1914	
B101	Keki village, upper Vailala River	Vailala River looking upstream from Keki village, Nov. 1914	
B102	Paku village, upper Vailala River	Village scene, Paku village, Nov. 1914	
B103	Keki village	Village scene, Nov. 1914	
B104	Junction of Dahile and Vailala Rivers	Junction of Dahile and Vailala Rivers, Nov. 1914	
B105	Junction of Vailala and Ivori Rivers	Junction of Vailala and Ivori Rivers, Nov. 1914	
B106	Upoia	Creek scene near Upoia, Nov. 1914	
B107	Upoia	Creek scene near Upoia showing very dense scrub, Nov. 1914	
B108	Ivori River	Scene on Ivori River—furthest north, Nov. 1914	
B109	Ivori River	Scene on Ivori River, Nov. 1914	
B110	Upoia	Tree observation tower station—Upoia, Dec. 1914	
B111	?	Nobigu and lady	
B112–114	?	?	Destroyed
B115	Upoia	Cook boys—Upoia; (left to right) Kio, Aupa and Ompe	
B116	Horu village near Upoia	Women making sago	
B117	Horu village	Woman making sago	
B118	Horu village	Woman making sago	
B119	Habia Camp	Boys with cassowary	
B120	Horu Village	Woman making basket	
B121	near Habia	Scene among bamboo	
B122	Keuru (between Vailala River and Kerema)	Crossing creek near Keuru, Feb. 1915	
B123	Keuru	Man shooting fish, Feb. 1915	
B124	Keuru	Motu-Motu canoe poling along coast, Feb. 1915	
B125	Keuru	Cave in Limestone near Bluff, Feb. 1915	
B126	Koraita near Kerema	Dancing men, Feb. 1915	
B127	Koraita	Dancing men, Feb. 1915	
B128	Koraita	Dancing men entering dubu, Feb. 1915	Destroyed
B129	Kerema	Boys spearing fish near Kerema, Feb. 1915	
B130	Kerema	Boys scrambling for tobacco, Feb. 1915	
B131	?	Man with Elephantiasis, Feb. 1915	
B132	Kerema	View from Kerema Station looking north, Feb. 1915	Destroyed
B133	Kerema	View from Kerema Station looking north, Feb. 1915	No print
B134a,b	Kerema	View from Kerema Station looking towards Mai [?] Point, Feb. 1915	No prints; two negatives, probably left to right panorama
B135–139	Upoia	Panoramic view from tree trig station, Upoia, for photographic survey work [left to right]	No prints; 135 destroyed; two negatives each of 136 and 138 (second with filter used)
B140–147	Upoia	Panoramic view from Bald Hill, Upoia, for photographic survey [left to right]	No prints; 147 destroyed
B148	Upoia	White bell fungus near Upoia (photographed from nature)	

B149	Upoia	Verandah scene at Upoia	No print
B150–151	Upoia	Panorama of Oilfield from behind Smith's house [left to right]	No prints
B152	Upoia	View towards Albert Ranges from Bald Hill	No print
B153–155	Upoia	Cloud studies	No prints
B156, 157	near Dua village	Women breaking down sago pith, March 1915	Destroyed
B158, 159	Dua Creek	Rock outcrop on Dua Creek near Gorge, March 1915	Destroyed
B160, 161	Ahia [?] village	Panoramic views from [?]Ahia village looking east [left to right]	No prints
B162	Upoia	Mess table, Upoia—J. Hodges, R. Bannon	
B163	Dua Village	Women breaking down sago pith near Dua village	
B164, 165	Dua village	View of camp near Dua village, March 1915	Destroyed
B166, 167	?	Still life study—Monkey Bar	Destroyed
B168–170	Borki	Scenes on Billabong near Borki, April 1915	
B171–173	Vailala River	Swamp tree (mangrove roots); moving camp by canoe	Destroyed

ALBUM C	LOCATION	USHER'S DESCRIPTION	INDEXER'S NOTES
C1	Orokolo	Church, London Missionary Society Station, Orokolo	
C2	Upoia?	Our white cook, T. McGowan [?]	Destroyed
C3	Upoia, Vailala River	Canoe scene	No print
C4	Upoia, Vailala River	Group of natives on riverbank	No print
C5	Upoia, Vailala River	Two natives on riverbank	No print
C6	Upoia, Vailala River	Canoe scene	No print
C7	Vailala River	Group of canoes and men	No print
C8	Vailala River	Canoe scene, Vailala river	No print
C9	?	My survey boys (left to right) Itori, Woro, Kelala, Hamoi and Dia	Negative numbered C10
C10	near Upoia	Track scene near Upoia on the Aro Aro track	
C11	near Upoia	Surveying new road, Upoia to the coast	
C12	?	Man and woman cutting up sago palm	Photo and negative missing
C13	?	Boy climbing coconut tree	
C14	Vailala river	Vailala river looking south from Letts	
C15	near Upoia	Camp scene	
C16	near Upoia	Prolific Poa Poa [pawpaw] tree	
C17	?	My cook boy Nobigu in dancing costume	
C18	Upoia	White quarters, Upoia (old style native house)	
C19	Upoia	Survey boys and survey canoe	
C20, 21	Upoia	Fault in rocks near Upoia—dull wet weather	
C22, 23	Upoia	Moving camp by canoe—Upoia	
C24	Nepaga village, Vailala River mouth	Scene at Nepaga village creek	
C25	Nepaga village	Old man	
C26	Nepaga village	Old man	
C27	Ijori village	Village scene—crotons	
C28	Nepaga village	Young boy with ulcers	
C29	Nepaga village	Two hunters with cuss-cuss	
C30	Maiva village, Mekeo district	Village scene	
C31	Berema village, Mekeo District	Roman Catholic Mission at Berema village	
C32	Berema village	Village scene	
C33, 34	Maiva village	Scenes at Maiva village	
C35	Kivoori Poe village near Yule Island	Women cutting little girls hair	
C36	Kivoori Poe village	Samoan Mission house	Negative missing
C37	Cape Possession	Cape Possession Beds	

C38	Yule Island	Outcrop of rock	
C39	Chiria Village, Yule Island	Old woman making pottery	
C40	Yule Island	Rescuing a horse	Negative missing
C41	Berena village.	Women tattooing	No print
C42	Yule Island	Scene at Yule Island looking towards Delena	
C43	Helau village, Vailala river mouth	Dubu at Helau village	
C44	Mohu village, Mekeo District	R.C.Mission at Mohu village	Photo and negative missing
C45	?	Portrait of two Mekeo boys	
C46	Mohu creek, Yule Island	Market scene, Mohu creek	
C47	Maiva village	Men with spears and shield	Negative missing
C48	Maiva village	Boys with bows and arrows	
C49	?	L. L. Wrathall off to enlist	
C50	Pinnapaka village, near Yule Island	Washing baby	
C51	Orokolo	Lawrence Schlenker, Orokolo, London Missionary Society	
C52	Orokolo	London Missionary Society Station, Orokolo	
C53	Biai	Dubu at Biai, sleeping quarters for G. Bryson (Appendicitis Hospital)	
C54	Vailala River mouth	Man with Elephantiasis	
C55	Vailala River mouth	Launching whale boat	
C56	Vailala River mouth	Launching a canoe log	
C57	Vailala River mouth	Women fishing in lagoon	
C58	Upoia	No.6 Bore, Upoia	
C59	Upoia	Tramway scene, Upoia	
C60	Vailala	Oilfield Launch, 'Vailala'	No print
C61	Vailala	Oilfields Launch	No print
C62, 63	?	Scenes in swamp showing Flying Foxes	No print of 63
C64	Vailala River	Vailala River scene, Loop No.2	
C65	Vailala River	Skipper and engineer of launch, 'Vailala'	Photo and negative missing
C66–68	Vailala	Photo of trees on road from Upoia to coast	No print of 68
C69	Vaiviri	McDonald's house, Vaiviri	
C70	?	Moresby Gifton on Launch 'Vailala'	
C71, 72	Vailala Oilfield	Bridge on the Upoia to Vaiviri track, Vailala Oilfield	C71 destroyed
C73	Vailala Oilfield	Large tree on the Upoia to Vaiviri track, Vailala Oilfield	Destroyed
C74	Purari Delta	Photographic expedition in Purari Delta, Christmas 1915	
C75	Iai village, Purari Delta	Iai village	Negative missing [Iai=Iari?]
C76	Iai village	Old men	
C77	Iai village	Young boys	
C78	Iai village	Young men	
C79	Iai village	Women and children	
C80	Iai village	Old men	
C81	Iai village	Interior of dubu (irava or men's club house)	Negative missing
C82	Iai village	Iai village Purari Delta	
C83	Iai village	Three women; centre one [is] a widow covered with white clay.	
C84	Kairu village, Purari Delta	Creek scene near Kairu village	Photo and negative missing
C85	Kairu village	Old men	
C86	Kairu village	Dwelling houses	
C87	Koropenaira village, Purari Delta	Aimunu (captives basket)	Koropenairu on maps

C88	Iai village	Village scene	
C89	Iai village	Canoe scene	
C90	Urika, Purari Delta	London Missionary Society station	
C91	Maipua village, Purari Delta	Returning from the gardens	
C92	U-Ki-Aravi village	Interior of lakatoi—showing method of housing	= U-k-iaravi (see C99,100, D3–7, etc)
C93	Kaimari village, Purari Delta	East End lakatoi at Purari Delta	Kaimare village; cf. C97
C94	Kaimari village	Street scene	
C95	Kaimari village	Women at Kaimari village	
C96–98	Kaimari village	General scene—panorama	C96 photo and negative missing
C99, 100	U-k-iaravi village	A lakatoi from East End of Papua waiting in Purari Delta for a load of sago given in exchange for load of pots and other trade goods	C99 negative missing

ALBUM D	LOCATION	USHER'S DESCRIPTION	INDEXER'S NOTES
D1	Maipua village, Purari Delta	General village scene at Maipua	
D2	Maipua village	Dwelling houses at Maipua	
D3	U-k-iaravi village, Purari Delta	Irava (club house)	A-ki-ravi or Ukai-ravi ? Negative missing
D4	U-k-iaravi village	General scene	
D5	U-k-iaravi village	Lakatoi, lakatoi house and canoe	cf. C99–100
D6	U-k-iaravi village	Interior of club house (irava)	Print incorrectly numbered D17 by Usher
D7	U-k-iaravi village	Front view of Kai-aimunu basket—flashlight photo taken in club house	Same as C87; suspect original D7 photo and negative destroyed
D8	Koropenaira village, Purari Delta	Interior of club house	
D9	U-k-iaravi village	Lakatoi at U-k-iaravi village	
D10	U-k-iaravi village	U-k-iaravi village showing large irava	
D11, 12	U-k-iaravi village	Two old men	
D13	U-k-iaravi village	Lakatoi at U-k-iaravi village	
D14, 15	near Urika Island, Purari Delta	Sago making	
D16	Kairu village, Purari Delta	Dwelling houses	
D17	Kairu village	Interior of irava or club house	Print incorrectly numbered D6 by Usher
D18	Kaimari village, Purari Delta	Two men, Kaimari village. Smaller one covered with clay being in mourning for a relative.	
D19	Kaimari village	Women at Kaimari village.	
D20	Kaimari village	Street scene	
D21	Orokolo village	Youths just out of irava	List states 'Ari-hovi village' [=Api-Opi?]
D22	Kaimari village	Hanuabada natives off Lakatoi at Kaimari village	
D23	Orokolo	Youths just out of irava where they have been confined for months; front view	List states 'Ari-hovi village' [=Api-Opi?]
D24	Orokolo	Youths who have just come out of the irava or club house after confinement of many months, now eligible to marry; back view	List states 'Ari-hovi village' [=Api-Opi?]
D25	Maipua village	Making sago with the feet	
D26	Orokolo village	Women fishing	
D27	Kaimari village	Young boy	Second negative D27 (no print) same subject slightly different position

D28	Ravi Kavau village, Purari Delta	Aimuno (Captives baskets)	
D29	Maipua village	Old man with piebald skin	Second negative D29 (no print) same subject slightly different position
D30	Maipua village	Widow	
D31	Orokolo village	Old woman with long curls	
D32	Orokolo village	Women returning from gardens	
D33	Orokolo village	Women fishing.	
D34	Orokolo district	Man with elephantiasis of legs	No print
D35	Orokolo district	Village Constable	No print
D36	Vailala village	Group of youths	No print
D37, 38	Samarai	Samarai, general views	
D39	Samarai	Samarai, view west side	
D40	Samarai	Scenic track among the coconuts, Samarai	
D41	Samarai	An avenue in Samarai	
D42	Samarai	Church of England in Samarai	

ALBUM E	**LOCATION**	**USHER'S DESCRIPTION**	**INDEXER'S NOTES**
E1–5	Rabaul, New Britain	Views of Süd Tochter ['South Daughter'] volcano and crater	
E6	Rabaul	View of the 'Mother' volcano from Government House	
E7	Rabaul	View of Rabaul Harbour from Government House	
E8	Matape [Matupit] Island, Rabaul	General view of village	
E9	Matape Island	Making fish traps	Negative missing
E10	Matape Island	Lieutenant Peterson and pony	
E11	Matape Island	Group of children	
E12	Matape Island	Typical house	
E13–26	Herbertshöhe, New Britain	Dance scenes	
E27	Herbertshöhe	The Pavilion (14 pigs) and native fruit for dance	
E28	Herbertshöhe	Scene on coconut plantation	
E29, 30	Rabaul	Views of Rabaul from the Harbour	E30 also titled 'Japanese Town'
E31, 32	Herbertshöhe	Signalling station	
E33	Herbertshöhe	Native Police	
E34	Herbertshöhe	Street scene	
E35	Herbertshöhe	Governors Residence	
E36	Herbertshöhe	Young boys with toy boats	
E37	Herbertshöhe	Typical canoe	
E38	Witu Island, New Britain	Rubber plantation	
E39	Witu Island	Cocoa Plantation	
E40	Witu Island	Native labourers	
E41	Witu Island	Canoe making	
E42	Witu Island	Village scene	
E43	Witu Island	Coconut plantation	
E44	Witu Island	Witu Lagoon	
E45	Witu Island	Crew and Officers of the 'Meklong' cargo boat	
E46	Witu Island	Officers of the 'Meklong' cargo boat	
E47	Witu Island	E. S. Usher on 'Meklong' cargo boat	
E48	Witu Island	Witu Lagoon	
E49–53	Morobe, German New Guinea	Scenes at Morobe	E53 also titled 'Morobe Station'
E54	Morobe	Native men	
E55	Morobe	Native women	
E56, 57	Ablingi Island, New Britain	Women and babies	Shows head binding

E58	Ablingi Island	Man and child	
E59	Ablingi Island	Group of women	
E60	Ablingi Island	Women unloading canoes	
E61	Ablingi Island	Two men (portrait)	
E62	Ablingi Island	Men with shields	
E63	Lindenhafen, New Britain	Two men (portrait)	
E64	Lindenhafen	Man (portrait)	
E65	Lindenhafen	Group of men	
E66	Morobe	Group and village scene	

ALBUM F	LOCATION	USHER'S DESCRIPTION	INDEXER'S NOTES
F1–2	Vella Lavella Island, Solomons	Women (Liapari), side and front views	
F3	Vella Lavella Island	War canoes	
F4	Vella Lavella Island	General view	Also titled 'Plantation'
F5	Vella Lavella Island	Island King (portrait)	
F6	Vella Lavella Island	Two boys (portrait)	Also titled 'Natives'
F7	Vella Lavella Island	Malaita boy (portrait)	'Boy' = man
F8	Vella Lavella Island	Women (portrait)	
F9	Faisi, Shortland Island Solomons	Canoe scene	
F10, 11	Faisi, Shortland Island	General views	
F12–14	Simbo Is., Solomons	Tambo Shrine	
F15, 16	Simbo Island	General views, Simbo Lagoon	
F17	Simbo Island	Village scene	
F18, 19	Gizo Island, Solomon Islands	Views from Government Station	Panorama, left to right
F20	Russell Island, Solomon Islands	Native Church, Melanesian Mission	
F21	Vella Lavella Island	Canoe scene	
F22	Vella Lavella Island	Group of women	
F23	Helavo village, Gela Is.	Helavo village	
F24	Gela Island	Ivory nut trees	
F25	Helavo village, Gela Is.	Church	
F26	Tulagi, Solomons	View of Tulagi	
F27, 28	Tulagi	Views of Tulagi Harbour (Panorama)	right to left
F29	Guadalcanar, Solomons	Canoe scene	
F30	Simbo, Solomons	Canoe scene	
F31, 32	Rere, Guadalcanar	Women preparing yams	
F33	Rere, Guadalcanar	Man with [neck] growth (portrait)	
F34	Rere, Guadalcanar	Man (portrait)	
F35	Rere, Guadalcanar	Women	
F36, 37	Tasimboko village, Beraude, Guadalcanar	Houses	Negative F37 missing
F38	Tasimboko village	Women preparing yams	
F39–40	Tasimboko village	Village scenes	
F41	Toombosa village, Beraude, Guadalcanar	Church	
F42	Toombosa village	Village Scene	
F43	Guadalcanar	Coconut Plantation	
F44	Guadalcanar	Loading horses	
F45	Beraude, Guadalcanar	Lever Bros Plantation	
F46	Gela Island, Solomons	Village scene (Voloa)	

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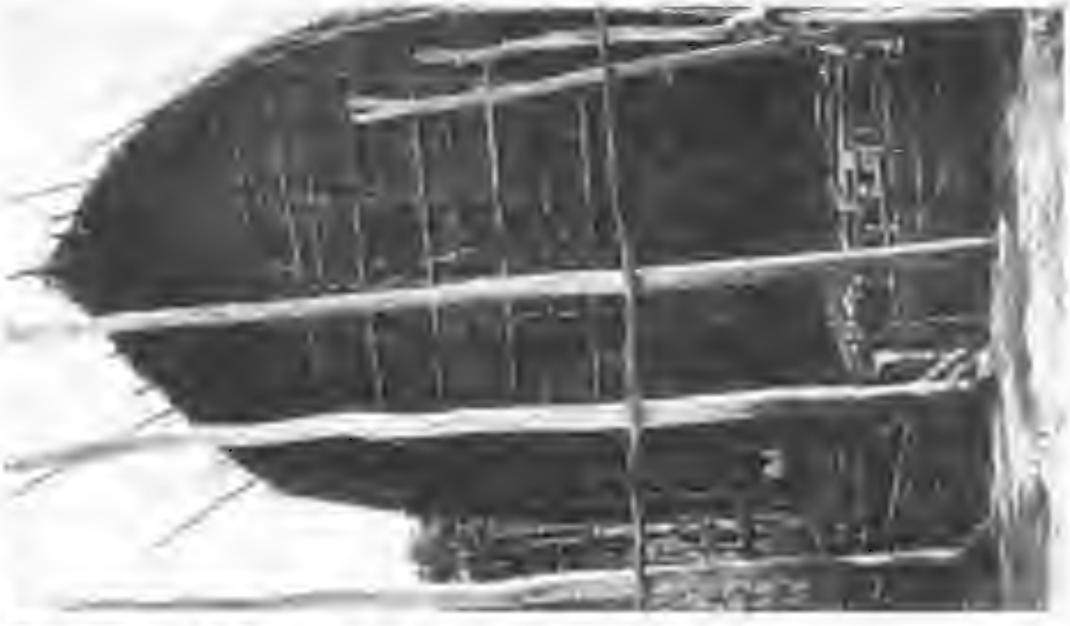

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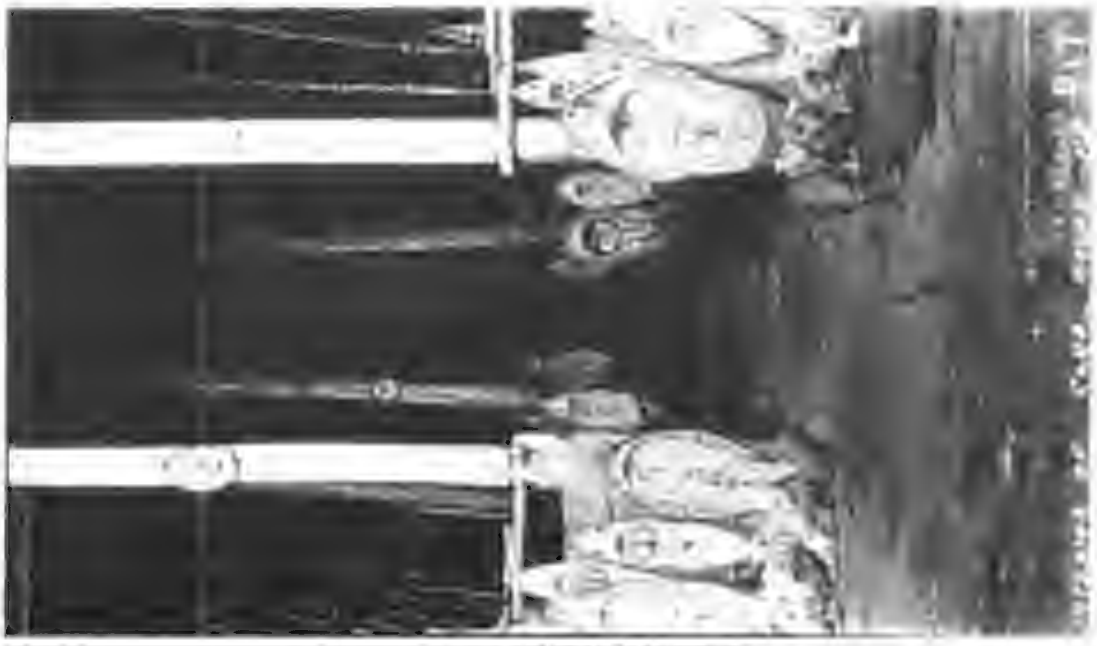

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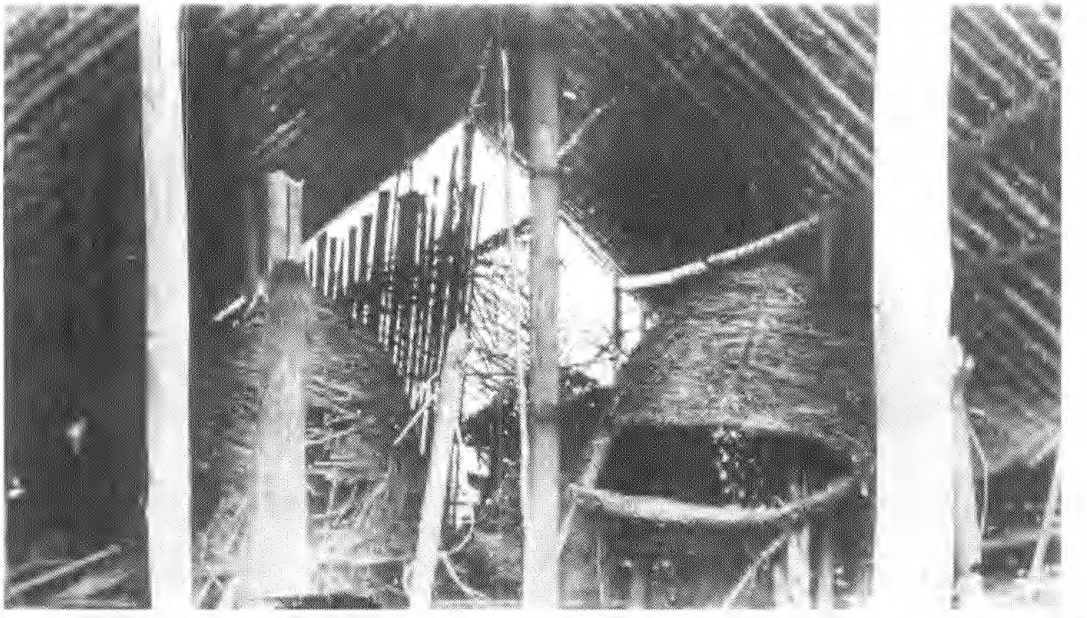

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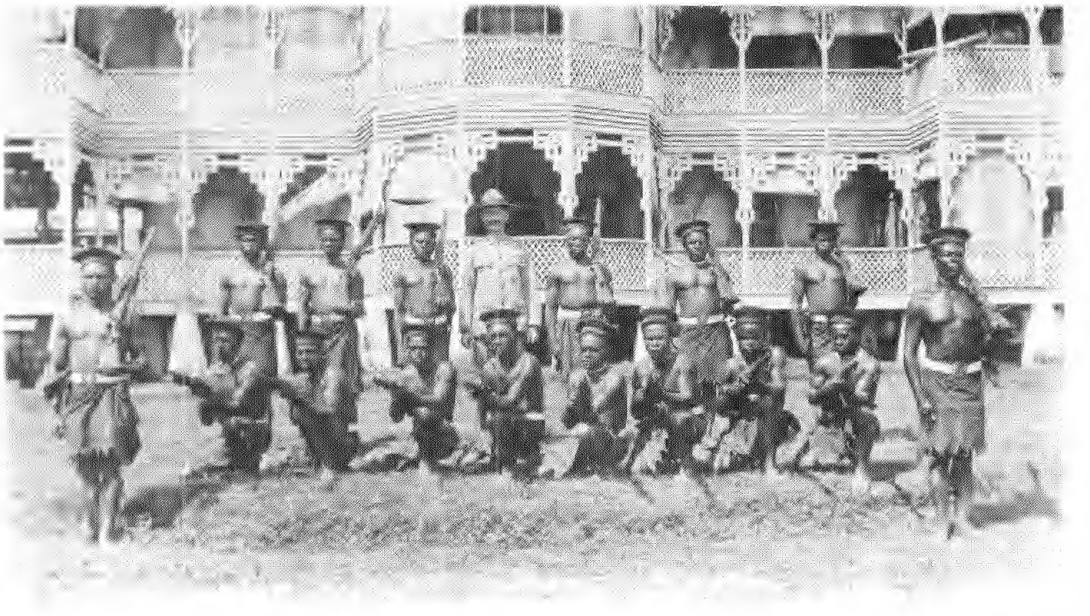

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